FINAL REPORT FOR

AIRBORNE RANGE AND ORBIT

DETERMINATION SYSTEM

4126-6001-RU-000

8 NOVEMBER 1963

VOLUME II

VEHICLE TRACKING TRANSMITTER

Prepared for

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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Huntsville, Alabama

CONTRACT NAS8-5482

TRW SPACE TECHNOLOGY LABORATORIES

THOMPSON RAMO WOOLDRIDGE INC.

Final Report for
Airborne Range and Orbit
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Volume II
Vehicle Tracking Transmitter

TABLE OF CONTENTS

2. VEHICLE TRACKING TRANSMITTER

2.1 Function of Equipment

The Vehicle Tracking Transmitter is an all solid-state unit that can drive a power amplifier or feed an antenna directly. The transmitted signals consists of a carrier at approximately 2200 MHz and four ranging tones phase modulated onto the carrier within the transmitter. The carrier is used to provide range rate information and the tones permit the determination of the range from an orbiting spacecraft to multiple transponders located on the earth.

The transmitter is normally used with the Vehicle Master Oscillator and Frequency Synthesizer (MOFS). The MOFS provides the RF drive signal frequency of approximately 71.138 MHz, and the transmitter provides a coherent output at 32 times the input drive frequency. The MOFS also provides the four ranging tones at frequencies between approximately 2.27 to 2.342 MHz to phase modulate the carrier.

2.2 Description of Equipment

The Vehicle Tracking Transmitter employs all solid-state components and is designed to operate between 2200 to 2300 MHz with a minimum output of 2.0 watts into a 50 ohm load. It is a coherent transmitter and therefore requires an input drive signal between 68.75 to 71.56 MHz at 10 milliwatts, $\pm$ 1 db. This drive signal is provided by the Master Oscillator and Frequency Synthesizer.

The transmitter is capable of being phase modulated by four modulation tones between 2.27 to 2.34 MHz at an input power of 10 milliwatts. Each of the four modulation signals are independently adjustable such that each tone can phase modulate the carrier at an index between 0.4 to 1.5 radians measured at the transmitter output. The four modulation tones are provided by the Master Oscillator and Frequency Synthesizer.

The dc input power consists of 30.0 volts at approximately 1.1 amperes. It is possible to operate the transmitter at input voltages between 28 to 32 volts, however, the test monitoring points have been calibrated for an input of 30 volts.

Test Monitor signals are provided for monitoring the transistor current in each stage, the various signal inputs, and the power output of the transmitter. These points provide a conditioned dc voltage (with the exception of the dc input voltage) and are convenient for continuously monitoring the transmitter performance while it is operating.

Test points are indicated inside the transmitter at various stages and and may be correlated with this manual to expedite trouble shooting.

The transmitter has been designed such that it can be mounted in any position. However, care must be taken to insure that the baseplate of the transmitter does not exceed the design temperature limits of 0°C to +60°C.

2.3 Theory of Operation

2.3.1 Circuit Diagram Analysis (Refer to drawing A10,001)

The purpose of the Buffer Amplifier is to provide isolation between the transmitter and the MOFS. The RF input signal from the MOFS unit at a frequency near 71.1 MHz is fed directly to the Buffer Amplifier. This unit is a common emitter-tuned collector transistor (2N915) amplifier. The input impedance is 50 ohm and the gain is 1 db. The unit is unilateralized by feedback from the secondary of A1-T1. The input and output power levels are approximately 10 and 125 mw, respectively.

The Buffer Amplifier drives a push-push varactor doubler. The symmetrical doubler configuration is used here because of its isolation characteristics between input and output frequencies, and also because of its design alignment simplicity. A trap is included in the unit (A1-L3, A1-C16 & A1-C17) so as to minimize the fundamental frequency component at the doubler output. The doubler efficiency is approximately 50%.

The output of the varactor doubler (at approximately 142.2 MHz) drives the phase modulator stage. The phase modulator consists of a 2N1493 transistor common emitter-tuned collector amplifier whose output tank circuit impedance is phase modulated by a pair of varactors. Phase modulation is produced by the variation of capacitance across the tank circuit causing a change in the phase of the circuit impedance. The modulation voltage is applied at the junction of the two varactors by the summing or Adder Amplifiers. The gain of the phase modulator is 7.6 db.

The four (4) range tone signals between approximately 2.27 to 2.34 MHz are applied to the input of their respective Adder Amplifiers. Each amplifier has a gain adjust control to independently vary the phase modulation index.

The output of the phase modulator stage is connected to the driver amplifier stage. The driver stage consists of a 2N2631 transistor common emitter-tuned collector amplifier with a power gain of approximately 5.1 db. The power output of this stage is nominally 1.0 watts.

The driver amplifier output is fed to the intermediate power amplifier. This stage consists of a DPT2600 power transistor connected in a common emitter-tuned collector configuration. This stage has a power gain of about 5.7 db, yielding an output power of 3.8 watts.

The final power amplifier consists of three DPT2600 power transistors connected in a parallel. Close symmetry is maintained by careful layout of the three power transistors. The final power amplifier has a power gain of approximately 5.3 db and produces 12.6 watts output.

The final power amplifier stage drives a push-push varactor doubler. The push-push doubler contains a pair of MA 4061A varactors. The conversion efficiency of this stage is about 80%.

Output of the first doubler stage (at approximately 284 MHz) is then cascaded to an identical push-push doubler. The output of this stage is at 567 MHz with a typical conversion efficiency of 72.5%. Because the two doublers are nearly identical in design, they are packaged in one module, referred to as the first quadrupler.

The 567 MHz output signal of the first quadrupler drives a single varactor doubler employing a coaxial resonator structure. The output of this doubler is at approximately 1136 MHz with a typical conversion efficiency of 68%.

The final doubler stage also utilizes a coaxial resonator structure. The output of this stage is at approximately 2.27 KMHz with a typical conversion efficiency of 60%. Because the last two doublers are almost identical in design, they are considered to be a single module and referred to as the second quadrupler.

The output from the second quadrupler feeds a double pole band-pass coaxial resonator filter. The insertion loss of the filter is nominally 0.4 db. The output of the filter is at the transmitter output connector. The transfer function of the filter is characterized by the 1 db points being 50 MHz and the 3 db points 70 MHz, both measured from the center frequency.

2.3.2 Power Distribution

The power distribution in the transmitter is tabulated as follows:

		Dc Power Input (mw)	RF Power Output (Typical)
Buffer		270	125 mw
Doubler		3	60 mw
Phase Modulator		1300	350 mw
Driver		1950-2250	1.0 W
Intermediate Power Amplifier		4500-6000	4.0 W
Final Amplifier		20,000-22,000	12.5 W
1st Quadrupler	1st doubler	0	9.5 W min
	2nd doubler	0	7 W min
2nd Quadrupler	1st doubler	0	4.5 W min
	2nd doubler	0	2.5 W min
Filter		0	2 W min

Vehicle Tracking Transmitter

Power Budget

2.3.3 Temperature Control

The Vehicle Tracking Transmitter must dissipate a maximum of 33 watts of heat by conduction through a base plate. The base plate is not supplied by the transmitter manufacturer. The design of the unit requires the base plate to be maintained between the temperature limits of $0^{\circ}C$ to $60^{\circ}C$.

2.4 Special Tools & Test Equipment

The following items (or equivalent) are required to perform minor alignment of the device in the field.

Power Supply (1)	Lambda LA20-05BM
Microwave Power Meter (1)	Hewlett-Packard 431
Microwave Power Meter (1)	Hewlett-Packard 434
Variable Attenuator (1)	General Radio 874-GAL
Spectrum Analyzer (1)	Lavoie LA-18M
Signal Generators (1)	Hewlett-Packard 608C
Signal Generators (1)	Hewlett-Packard 606
Noise & Field Intensity Meter (1)	Empire Devices NF-105 with tuning units from 20 to 1000 MHz
Noise & Field Intensity Meter (1)	Empire Devices NF-112 with tuning units from 1-9 KMHz
Volt-Ohm Milliammeter (1)	Triplett 630NA
50 Ohm coaxial cables (6)	6 feet long fitted with BNC connectors
Variable Capacitor 8.5 pf (1)	JFD, VC206
Cavity Alignment Tool (1)	Provided with transmitter by the manufacturer

2.5 Maintenance

2.5.1 Maintenance Precautions

Before energizing the transmitter, the following precautions should be taken.

2.5.1.1 Check to see that the transmitter is fastened to an adequate cooling plate. This plate must dissipate 33 watts of heat. It must be maintained between the temperature limits of $0^{\circ}C$ and $+60^{\circ}C$.

2.5.1.2 Check to see that the transmitter output (A8-J6) is connected to a 50 ± 10 ohm resistive load.

2.5.1.3 Check to see that the power supply used to energize the unit is properly polarized and that its voltage is within specification. The correct voltage is 30 ± 2 volts. The transmitter can withstand voltage transients up to +40 volts provided the pulse duration is less than 10 msec, and the pulse repetition rate is less than 1 pulse per second.

2.5.2 Alignment Procedure

2.5.2.1 Mount the Vehicle Tracking Transmitter to its cooling plate.

2.5.2.2 Buffer Amplifier

2.5.2.2.1 Connect an oscillator (Hewlett-Packard 608C or equivalent) to A8-J1 by means of a 50 ohm cable. Set the oscillator to deliver 10 mw C. W. at the input frequency (71.138 MHz).

2.5.2.2.2 Disconnect A1-C9 capacitor from the collector of A1-Q1 transistor.

2.5.2.2.3 Connect a power meter (Hewlett-Packard 434) to the collector of transistor A1-Q1 through an 8.5 pf variable capacitor (JFD, VC206 or equivalent) as shown in Figure 1.

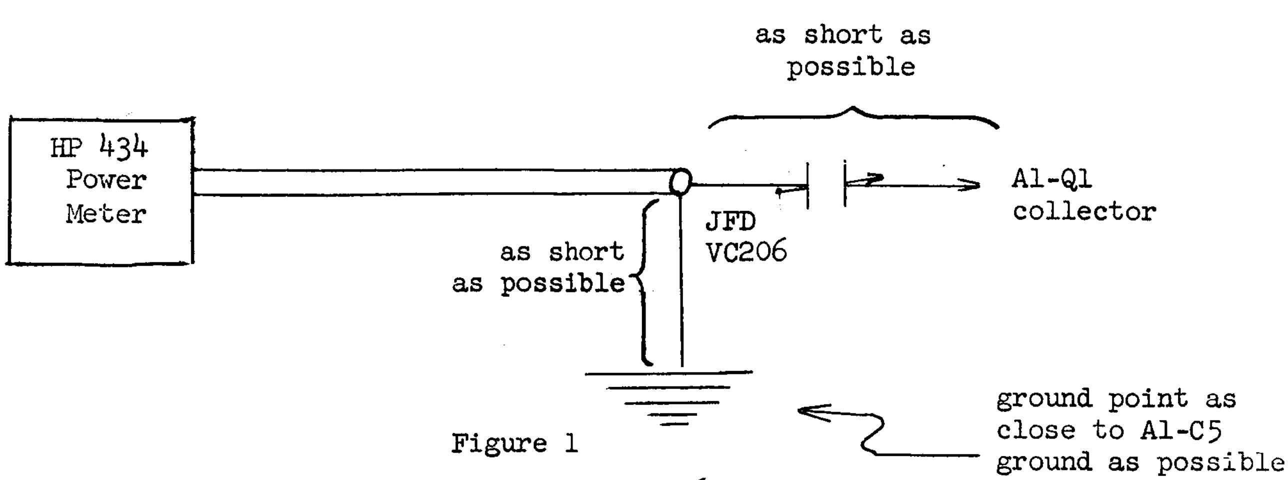


Figure 1

2.5.2.2.4 Apply +30 $\pm$ 1 volt and ground from a power supply (Lambda-LA20-05BM or equivalent) to A8-J7.

2.5.2.2.5 Adjust A1-C1, A1-C6 and the capacitor described in 2.5.2.2.3 so as to maximize the power delivered to the power meter. The power should be 100 mw minimum.

2.5.2.2.6 Disconnect the power supply.

2.5.2.2.7 Disconnect the power meter from the apparatus described in 2.5.2.2.3.

2.5.2.2.8 Disconnect the oscillator from A8-J1 and connect it in place of the power meter in the apparatus described in 2.5.2.2.3. Maintain the same frequency and power level at the oscillator.

2.5.2.2.9 Connect a noise and field intensity meter (Empire Devices NF-105 or equivalent) to A8-J1. Tune the noise meter to the oscillator frequency.

2.5.2.2.10 Adjust A1-C7 to minimize the power at the noise meter. The power level at the noise meter should be 40 db below the level at the oscillator.

2.5.2.2.11 Disconnect the +30 volts from A8-J7.

2.5.2.2.12 Disconnect the noise meter and the apparatus described in 2.5.2.2.3 from the transmitter. Replace A1-C9 capacitor.

2.5.2.3 Varactor Doubler

2.5.2.3.1 Disconnect A1-C20 capacitor from the junction of TP3, A1-C18, A1-C19 and A1-C26. Connect a power meter (Hewlett-Packard HP434 or equivalent) to TP3 with a 50 ohm cable.

2.5.2.3.2 Connect an oscillator (Hewlett-Packard 608C or equivalent) to A8-J1. Apply +30 volt to A8-J7. Adjust the oscillator to deliver 10 mw of C.W. at 71.138 MHz,.

2.5.2.3.3 Adjust A1-C11, A1-C15 and A1-C18 capacitors to maximize the output power. Disconnect the +30 volts from A8-J7. Disconnect the power meter from TP3.

2.5.2.3.4 With a 50 ohm cable connect TP3 to noise and field intensity meter (Empire Devices NF-105 or equivalent). Reconnect the +30 volts to A8-J7. Tune the noise meter to the input frequency.

2.5.2.3.5 Adjust A1-C16 to minimize the power at the noise meter. Disconnect the +30 volts from A8-J7. Disconnect the noise meter.

2.5.2.3.6 Connect power meter (Hewlett-Packard HP 434 or equivalent) to TP3 by a 50 ohm cable, and repeat 2.5.2.3.2 and 2.5.2.3.3. The output power should be at least 50 mw.

2.5.2.3.7 Disconnect +30 volts from A8-J7 and the power meter.

2.5.2.3.8 Reconnect A1-C20 capacitor to the junction of TP3, A1-C18, A1-C19 and A1-C26 capacitor.

2.5.2.4 Phase Modulator

2.5.2.4.1 Disconnect the junction of TP3 and A1-C27 capacitor from module A2 (Driver).

2.5.2.4.2 Connect a power meter (Hewlett-Packard 434 or equivalent) to TP4 by a 50 ohm cable. Apply +30 volt to A8-J7.

2.5.2.4.3 Adjust A1-C22 and A1-C27 capacitors to maximize the power output. The power level should be at least 300 mw.

2.5.2.4.4 Disconnect the +30 volt from A8-J7. Disconnect the power meter. Reconnect the junction of TP4 and A1-C27 capacitor to module A2.

2.5.2.5 Driver Amplifier

2.5.2.5.1 Disconnect the Driver from the Intermediate Power Amplifier at the junction of A3-C1, A3-C2, A3-C3, A2-C10 and A2-C11 capacitors. The A2-C10 capacitor terminal opposite to the junction of A2-C10, A2-C11 capacitors and A3-L4 inductor is designated TP5.

2.5.2.5.2 Connect a power meter (Hewlett-Packard 434 or equivalent) to TP5 by a 50 ohm cable.

2.5.2.5.3 Connect +30 volts to A8-J7 and adjust A2-C1, A2-C9, A2-C11 and A1-C27 to maximize the power output. Power level should be 1 watt typical.

2.5.2.5.4 Disconnect the +30 volts from A8-J7.

2.5.2.5.5 Connect the Driver to the Intermediate Power Amplifier at the junction of A3-C1, A3-C2, A3-C3, A2-C10 and A2-C11 capacitors.

2.5.2.6 Intermediate Power Amplifier and Final Amplifier

2.5.2.6.1 Disconnect A5-C1 and A5-C2 from the junction of A3-C33, A3-C34, A3-C35, A3-C36 which is TP13.

2.5.2.6.2 Connect TP13 to a power meter(Hewlett-Packard 434 or equivalent) with a 50 ohm cable and a suitable attenuation pad (Empire Devices, AT70-6 db or equivalent).

2.5.2.6.3 Connect a voltmeter (Triplett 630NA or equivalent) between ground and pin K of A8-J7.

2.5.2.6.4 Connect +30 volts to A8-J7.

2.5.2.6.5 Adjust A3-C1 capacitor to maximize the voltage on the voltmeter.

2.5.2.6.6 Disconnect the voltmeter from pin K of A8-J7 and connect it to TP6.

2.5.2.6.7 Adjust A3-C13 to maximize the voltage at TP6.

2.5.2.6.8 Disconnect the voltmeter and adjust A3-C33 and A3-C36 capacitors to maximize the power at TP13.

2.5.2.6.9 Adjust A3-C1, A3-C13, A3-C33 and A3-C36 repeatedly until the power output is maximized. It should be at least 12.0 watts.

2.5.2.6.10 Disconnect the +30 volt from A8-J7.

2.5.2.8.12 Module A5, A6 and A7 are adjusted at the factory. If these modules become badly misaligned they will have to be returned to the manufacturer for realignment. A slight realignment can be performed in the field as follows: Connect a wattmeter (Hewlett-Packard 434 or equivalent) to A8-J6 by means of a 50 ohm cable.

2.5.2.8.13 Adjust the 4 cavity tuning studs, A6-C1 and A6-C2 repeatedly to maximize the output power. Also adjust A5-C1, C3, C4, C6 to maximize power.

2.5.2.8.14 Disconnect the +30 volt from A8-J7.

2.5.2.9 Adder Amplifiers

2.5.2.9.1 Insert an attenuator (General Radio, 874-GA or equivalent) between A8-J6 and the power meter so that the output power is delivered to the meter by the fixed low loss channel of the attenuator.

2.5.2.9.2 Connect a spectrum analyzer to the variable attenuation part of the attenuator by means of a 50 ohm cable.

2.5.2.9.3 Adjust the attenuator to an indicated 25 db.

2.5.2.9.4 Connect an oscillator (Hewlett-Packard 606 or equivalent) to A8-J2. Adjust its frequency to 2.27 MHz and its output power to zero.

2.5.2.9.5 Connect +30 volts to A8-J7.

2.5.2.9.6 Tune the spectrum analyzer, to the output frequency (2.28 KMHz approximately) and adjust the spectrum width to 10 MHz approximately.

2.5.2.9.7 Observe the spectrum analyzer and adjust A4-R6 to make the first pair of sidebands approach 36% of the magnitude of the modulated carrier as the power of the 2.27 MHz oscillator is raised to 10 mw. All other sidebands should have less amplitude than both the carrier and the first order sidebands.

2.5.2.9.8 The remaining portions of the Adder Amplifier is adjusted in a similar manner. The modulation frequency and sideband amplitudes must conform to the following table:

Modulation Frequency MHz	Apply Modulation Signal to	Adjust	Modulated Carrier Frequency Amplitude Voltage	First Order Sideband Amplitude Voltage
2.27	A8-J2	A4-R6	Full scale when modulated	36% Full Scale
2.34	A8-J3	A4-R15	Full scale when modulated	50% Full Scale
2.34	A8-J4	A4-R24	Full scale when modulated	50% Full Scale
2.342	A8-J5	A4-R33	Full scale when modulated	70% Full Scale

2.5.2.9.9 Disconnect the +30 volts and ground from A8-J7.

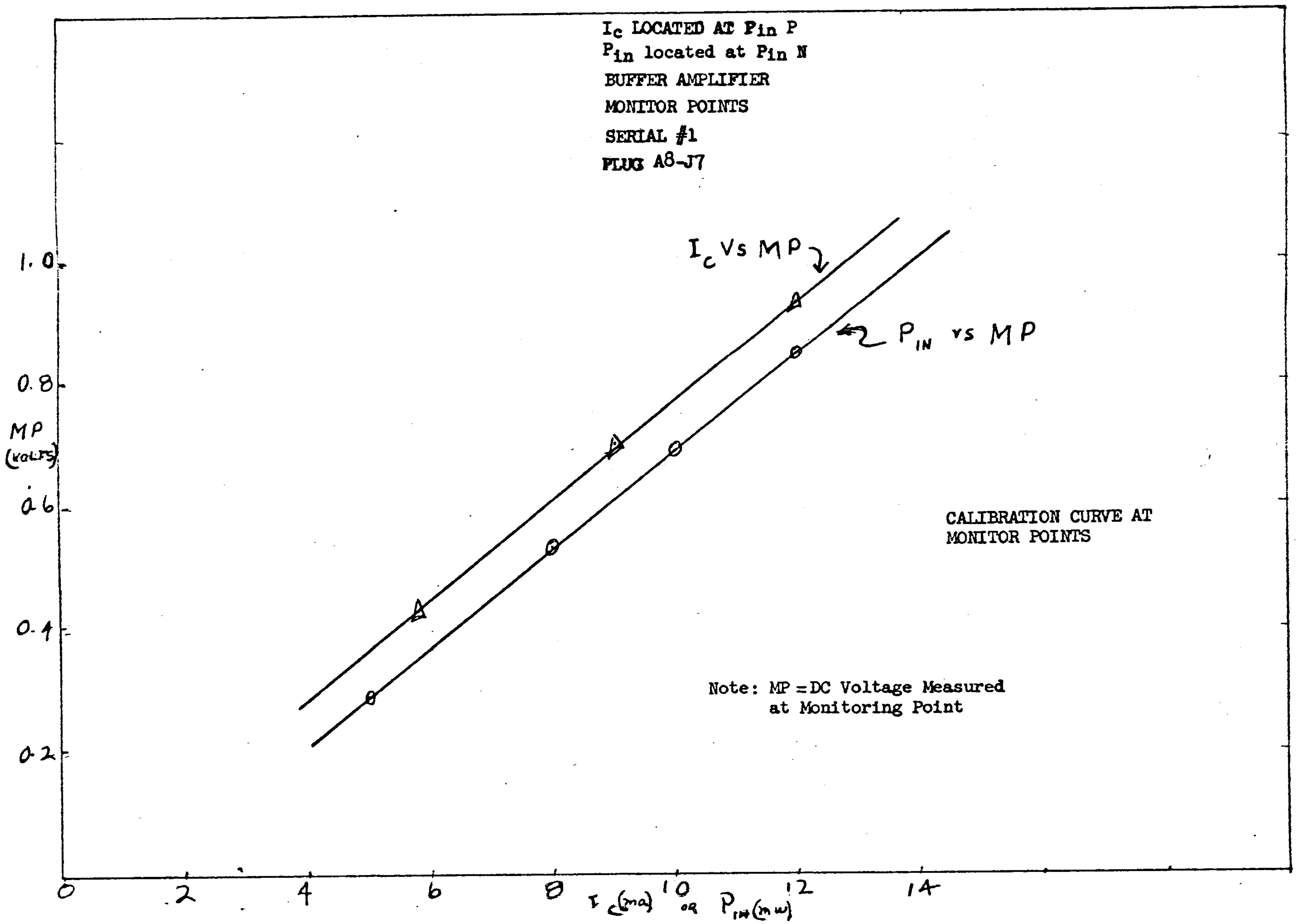
2.5.2.9.10 Disconnect the remaining test apparatus, remove the cooling plate from the transmitter. The unit is now adjusted.

2.5.3 <u>Trouble Shooting</u>

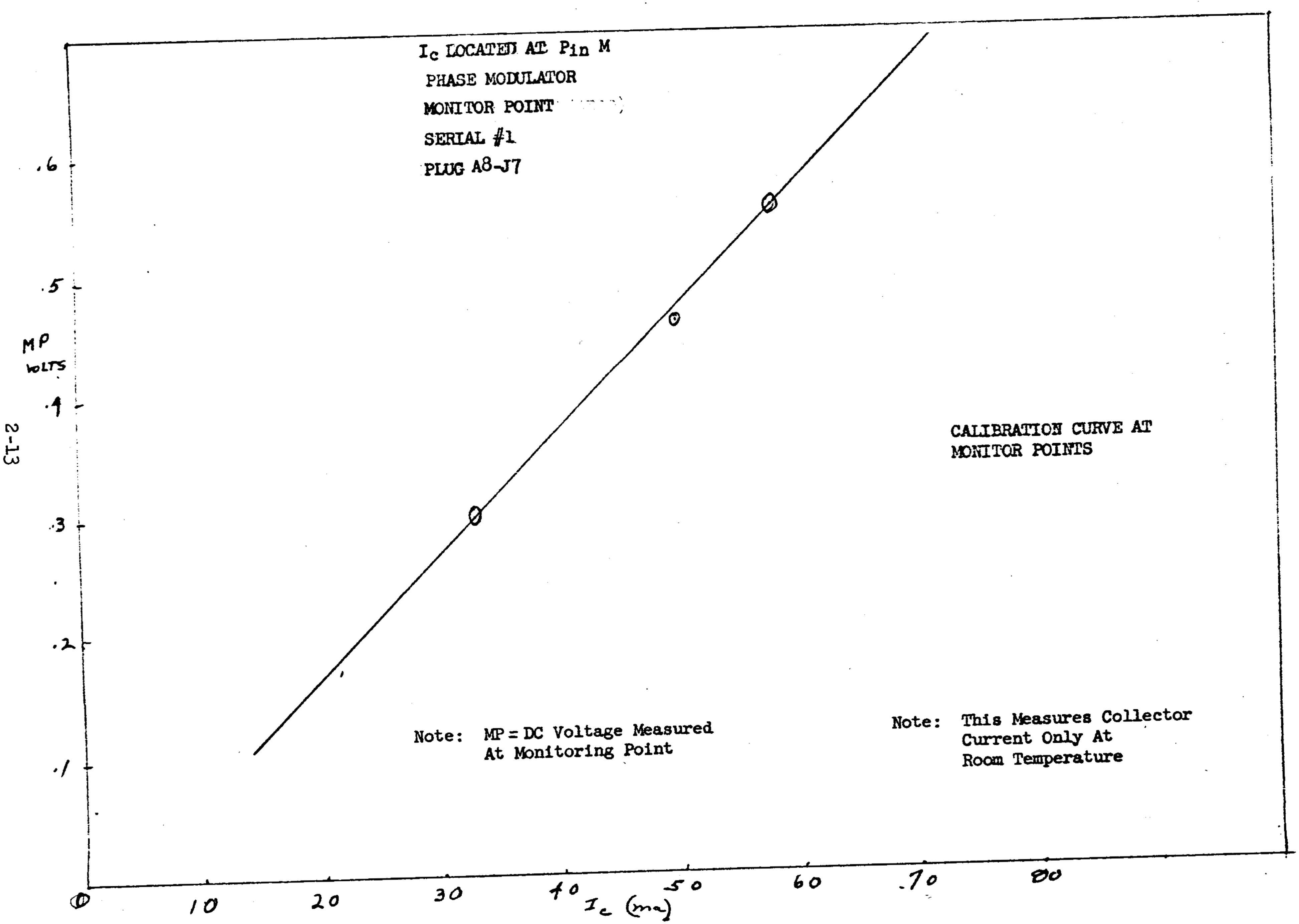
It is not intended that the extensive repairs be made to this equipment in the field. It will generally be necessary to return the transmitter to the manufacturer if a failure should develop. If a field repair is to be attempted, the best approach would be to go through the alignment procedure. As this is done, comparison should be made between the measured signal levels and the typical RF Power Output tabulated in the Power Distribution section (2.3.3). This comparison should localize the problem to one stage. A visual inspection of the problem area should be made. If facilities are available, the semiconductor devices in the faulty stage should be tested and replaced if defective.

2.6 Calibration Curves

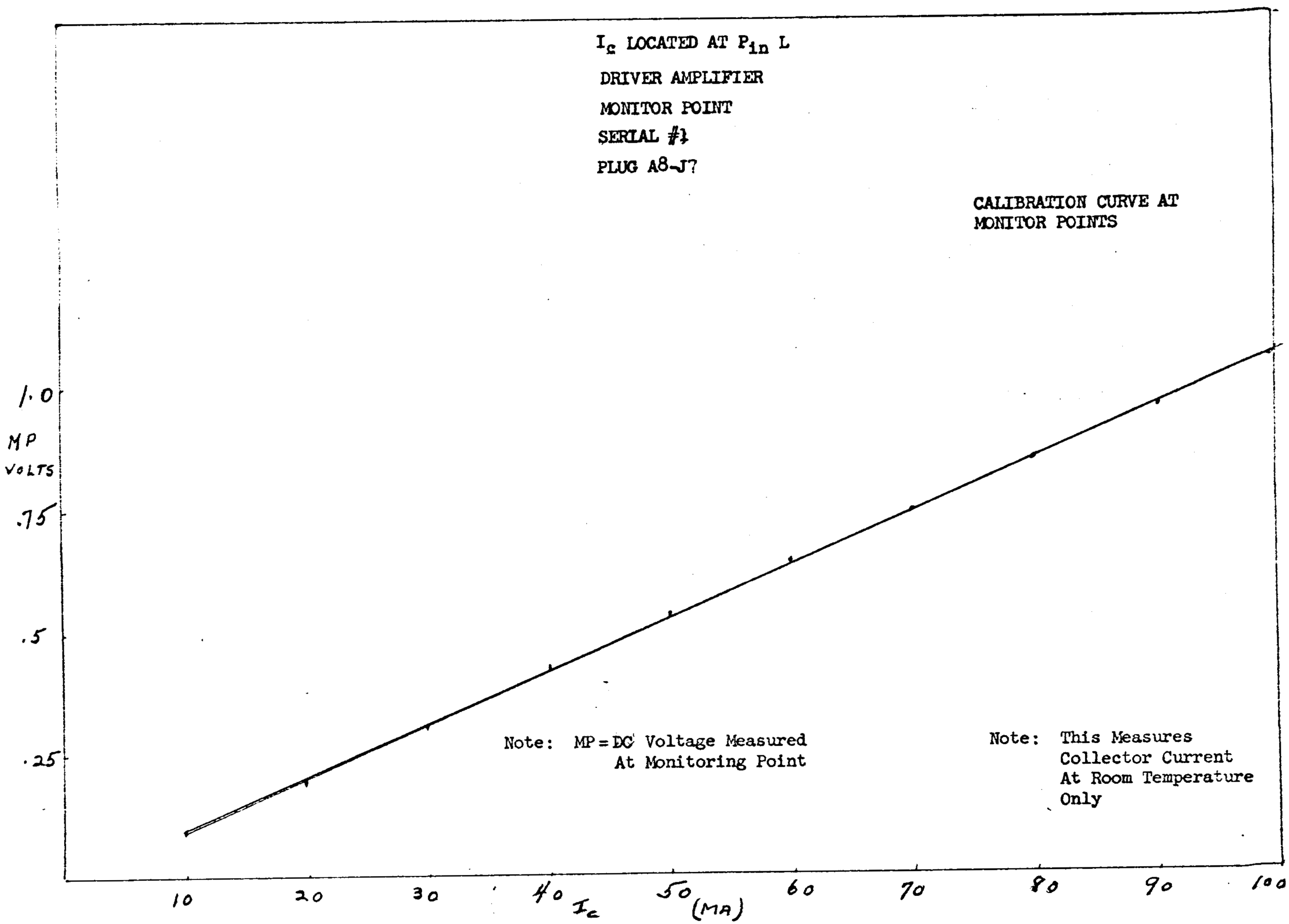
The following curves are included as diagnostic aids in the event that the unit should fail in the field. Each curve shows how the variation of actual power or current is conditioned to the d-c values as measured at the respective monitor points. The correct interpretation of test results requires the services of a knowledgeable engineer; but in general, any portion of the unit that departs markedly from the depicted pattern of behavior is apt to be defective.

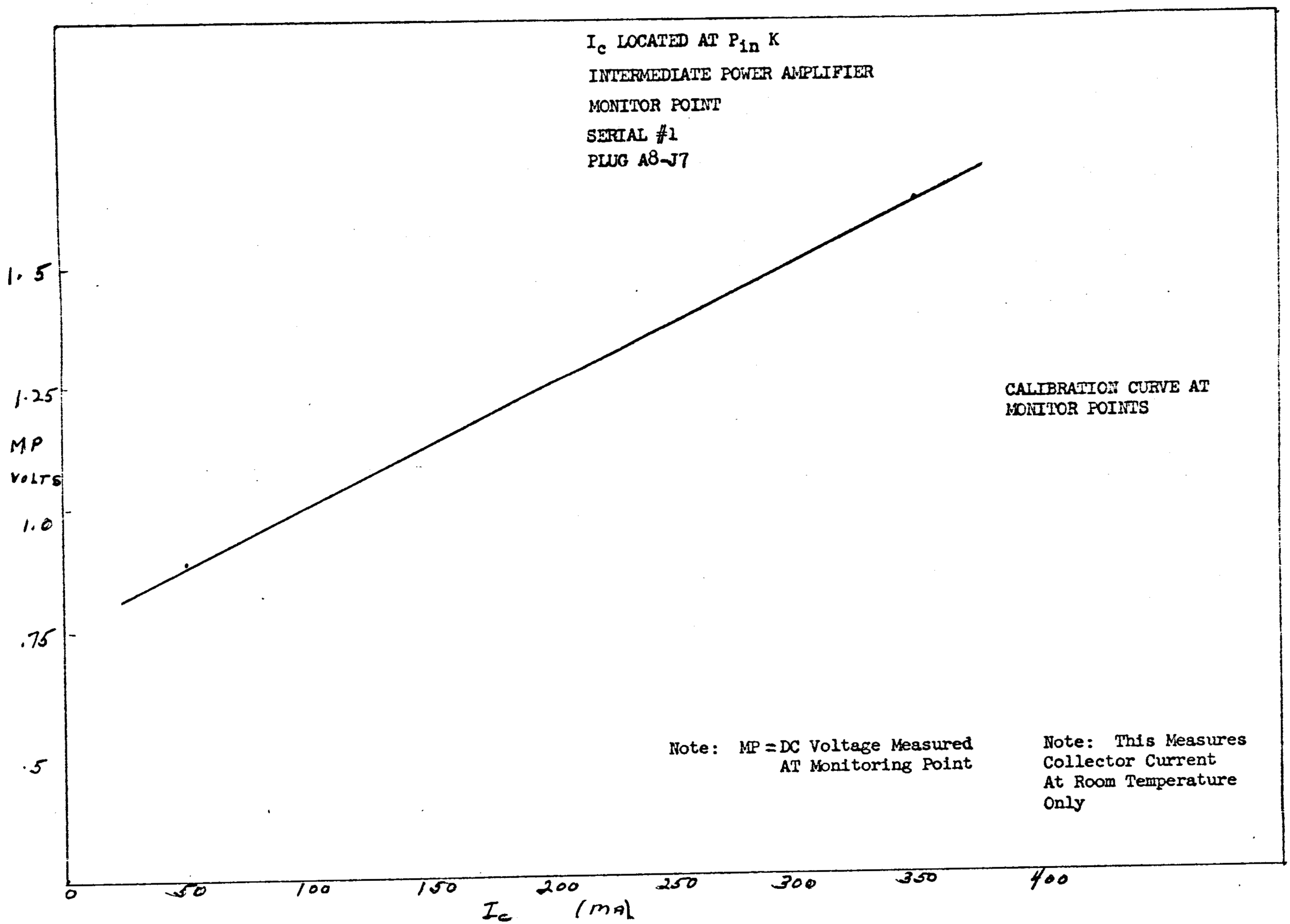


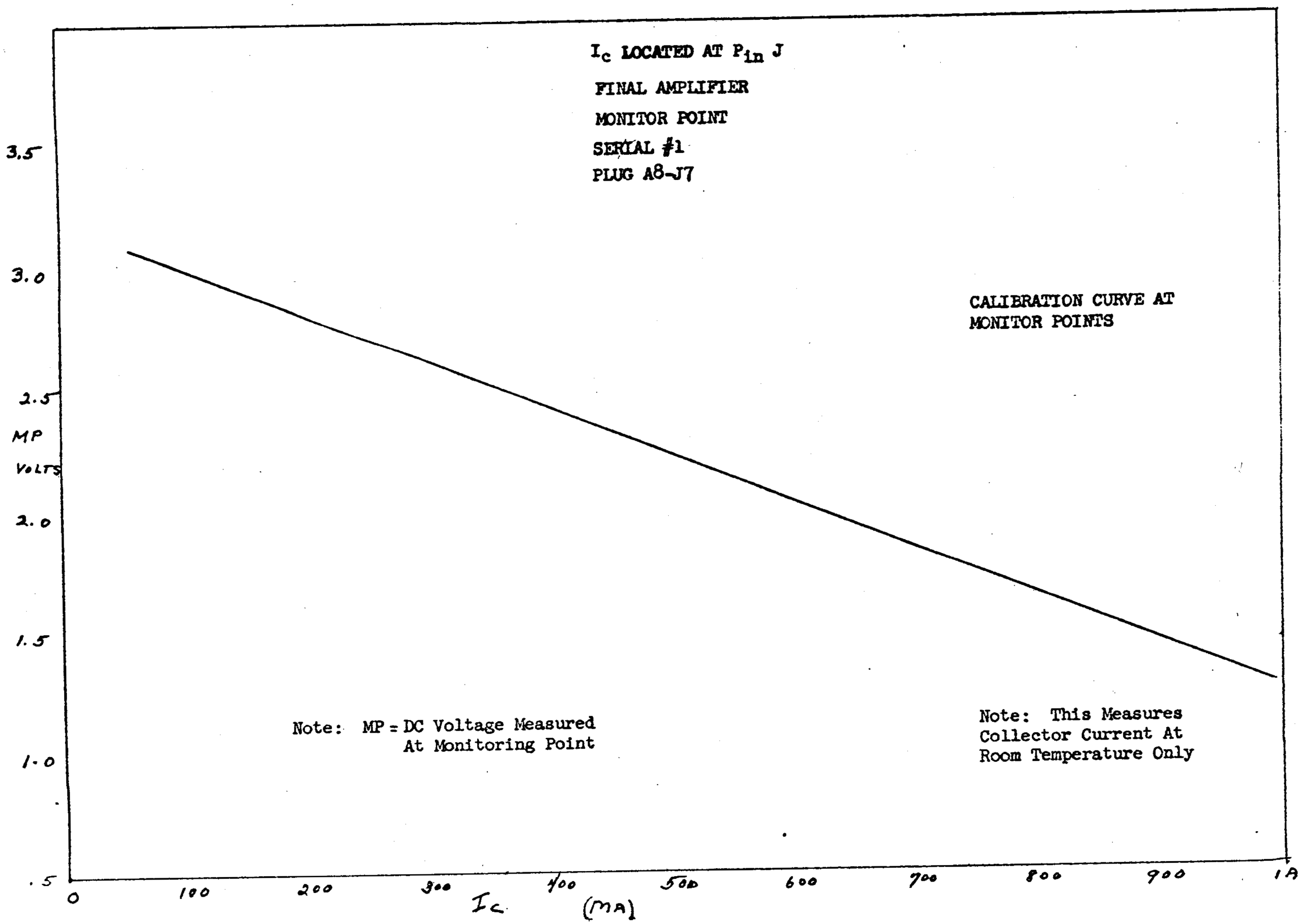
I_c LOCATED AT P_{in} P
P_{in} located at P_{in} N
BUFFER AMPLIFIER
MONITOR POINTS
SERIAL #1
PLUG A8-J7
I_c Vs MP
P_{IN} vs MP
CALIBRATION CURVE AT
MONITOR POINTS
Note: MP = DC Voltage Measured
at Monitoring Point
MP (VOLTS)
1.0
0.8
0.6
0.4
0.2
0
2
4
6
8
10
12
14
I_c (ma) or P_{IN} (mw)



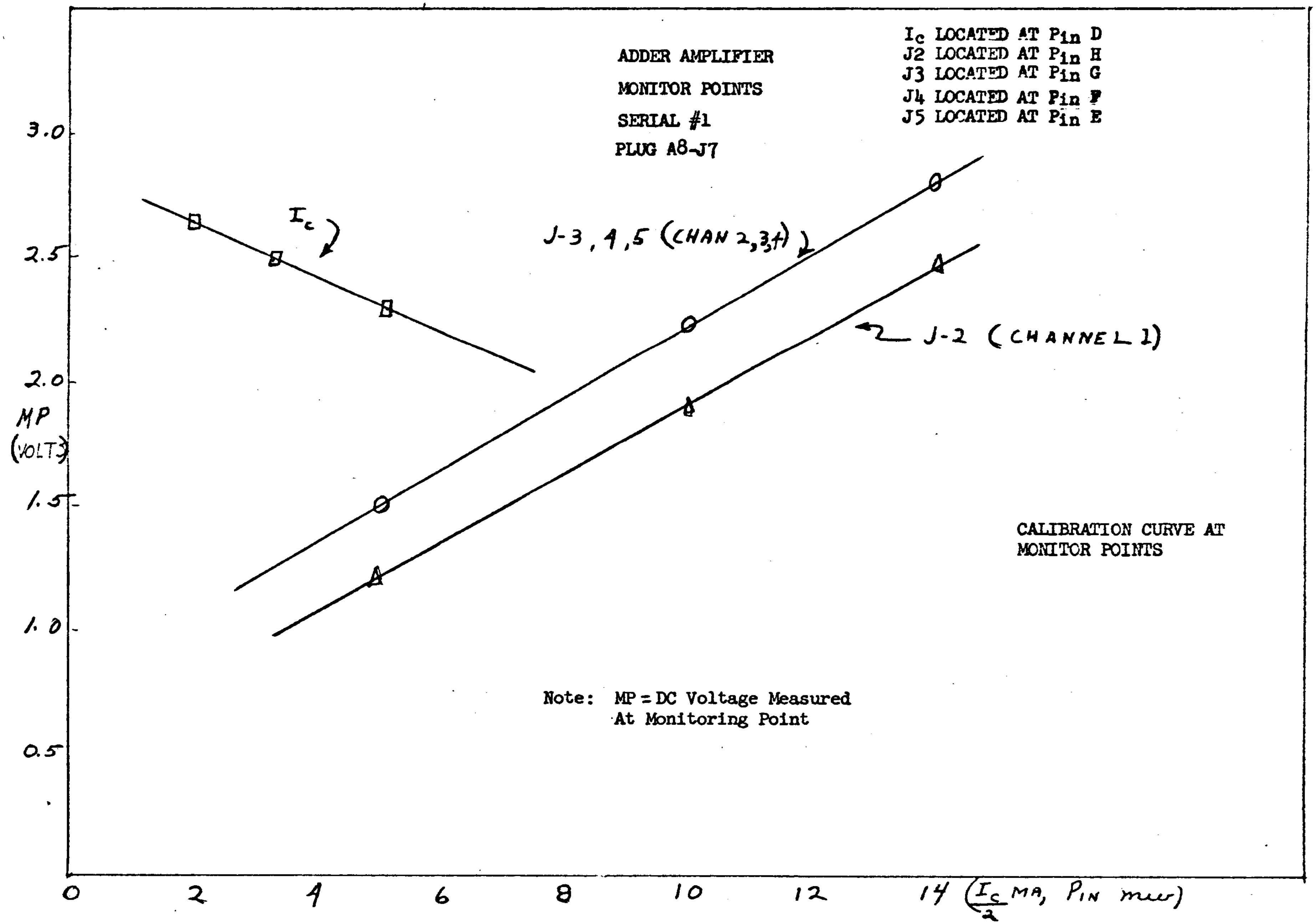
I_c LOCATED AT Pin M
PHASE MODULATOR
MONITOR POINT
SERIAL #1
PLUG A8-J7
CALIBRATION CURVE AT
MONITOR POINTS
Note: MP = DC Voltage Measured
At Monitoring Point
Note: This Measures Collector
Current Only At
Room Temperature
MP
VOLTS
.6
.5
.4
.3
.2
.1
0
10
20
30
40
50
60
70
80
I_c (ma)

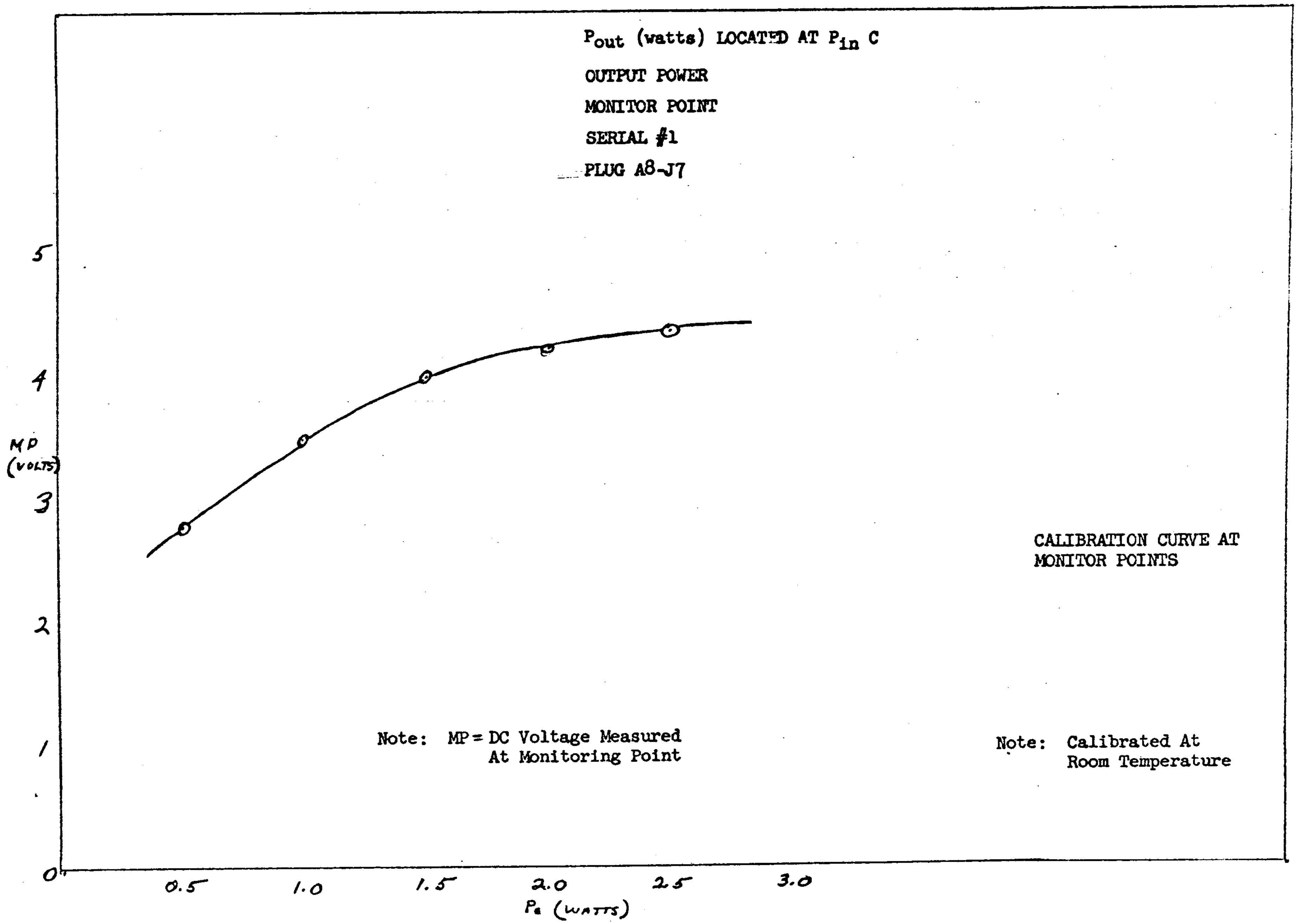

I_c LOCATED AT P_{in} L
DRIVER AMPLIFIER
MONITOR POINT
SERIAL #1
PLUG A8-J7
CALIBRATION CURVE AT
MONITOR POINTS
1.0
MP
VOLTS
.75
.5
.25
Note: MP = DC Voltage Measured
At Monitoring Point
Note: This Measures
Collector Current
At Room Temperature
Only
10
20
30
40
I_c
50
(MA)
60
70
80
90
100


I_c LOCATED AT P_{in} K
INTERMEDIATE POWER AMPLIFIER
MONITOR POINT
SERIAL #1
PLUG A8-J7
CALIBRATION CURVE AT
MONITOR POINTS
Note: MP = DC Voltage Measured
AT Monitoring Point
Note: This Measures
Collector Current
At Room Temperature
Only
1.5
1.25
MP
VOLTS
1.0
.75
.5
0
50
100
150
200
250
300
350
400
I_c (mA)



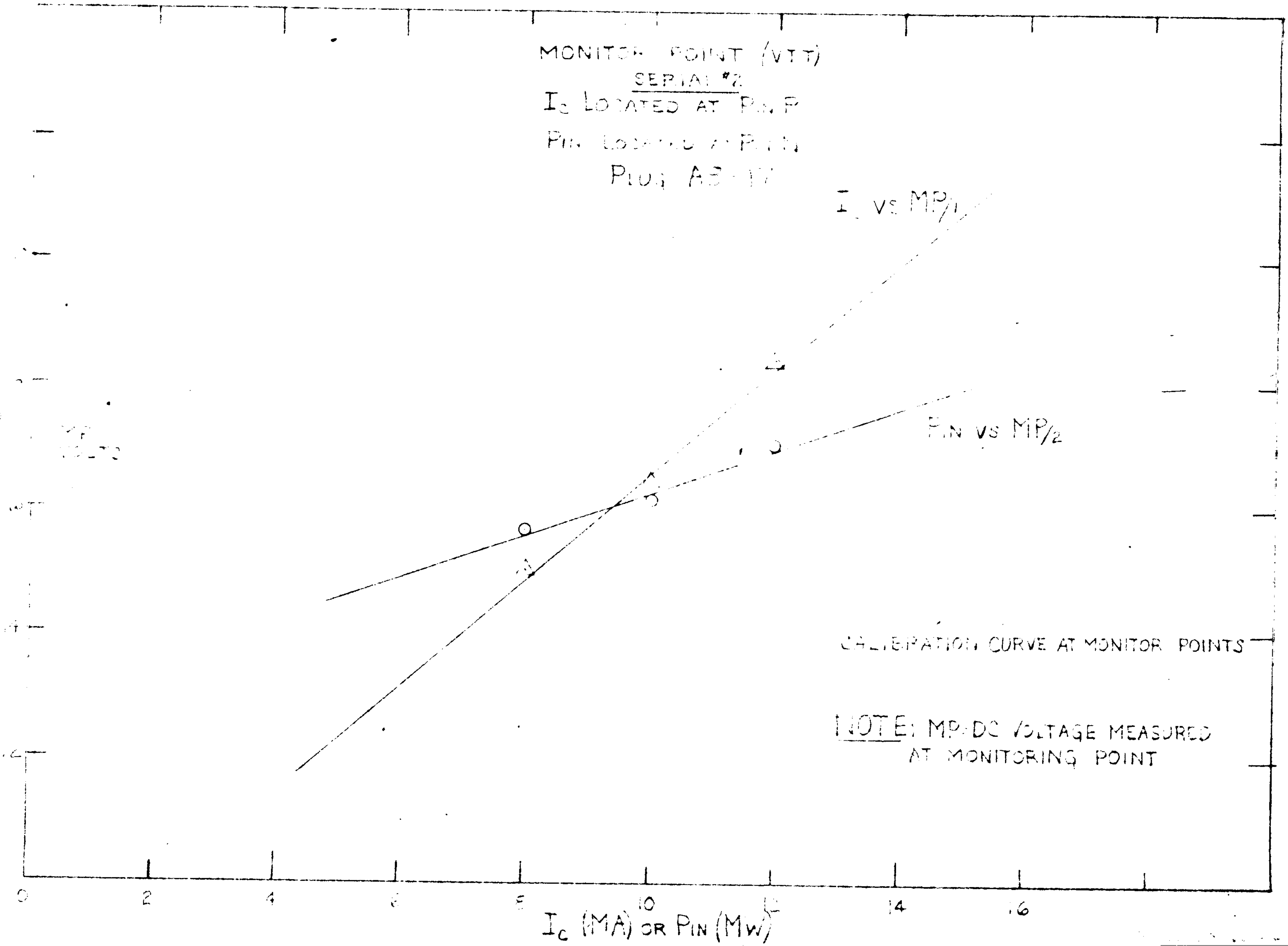
I$_c$ LOCATED AT P$_{in}$ J
FINAL AMPLIFIER
MONITOR POINT
SERIAL #1
PLUG A8-J7
CALIBRATION CURVE AT
MONITOR POINTS
Note: MP = DC Voltage Measured
At Monitoring Point
Note: This Measures
Collector Current At
Room Temperature Only
3.5
3.0
2.5
MP
VOLTS
2.0
1.5
1.0
.5
0
100
200
300
400
500
600
700
800
900
1A
I$_c$
(mA)


ADDER AMPLIFIER
MONITOR POINTS
SERIAL #1
PLUG A8-J7
I_c LOCATED AT Pin D
J2 LOCATED AT Pin H
J3 LOCATED AT Pin G
J4 LOCATED AT Pin F
J5 LOCATED AT Pin E
I_c
J-3, 4, 5 (CHAN 2, 3, 4)
J-2 (CHANNEL 1)
CALIBRATION CURVE AT
MONITOR POINTS
Note: MP = DC Voltage Measured
At Monitoring Point
MP (VOLT)
3.0
2.5
2.0
1.5
1.0
0.5
0
2
4
6
8
10
12
14
($\frac{I_c}{2}$ MA, P_{IN} mw)

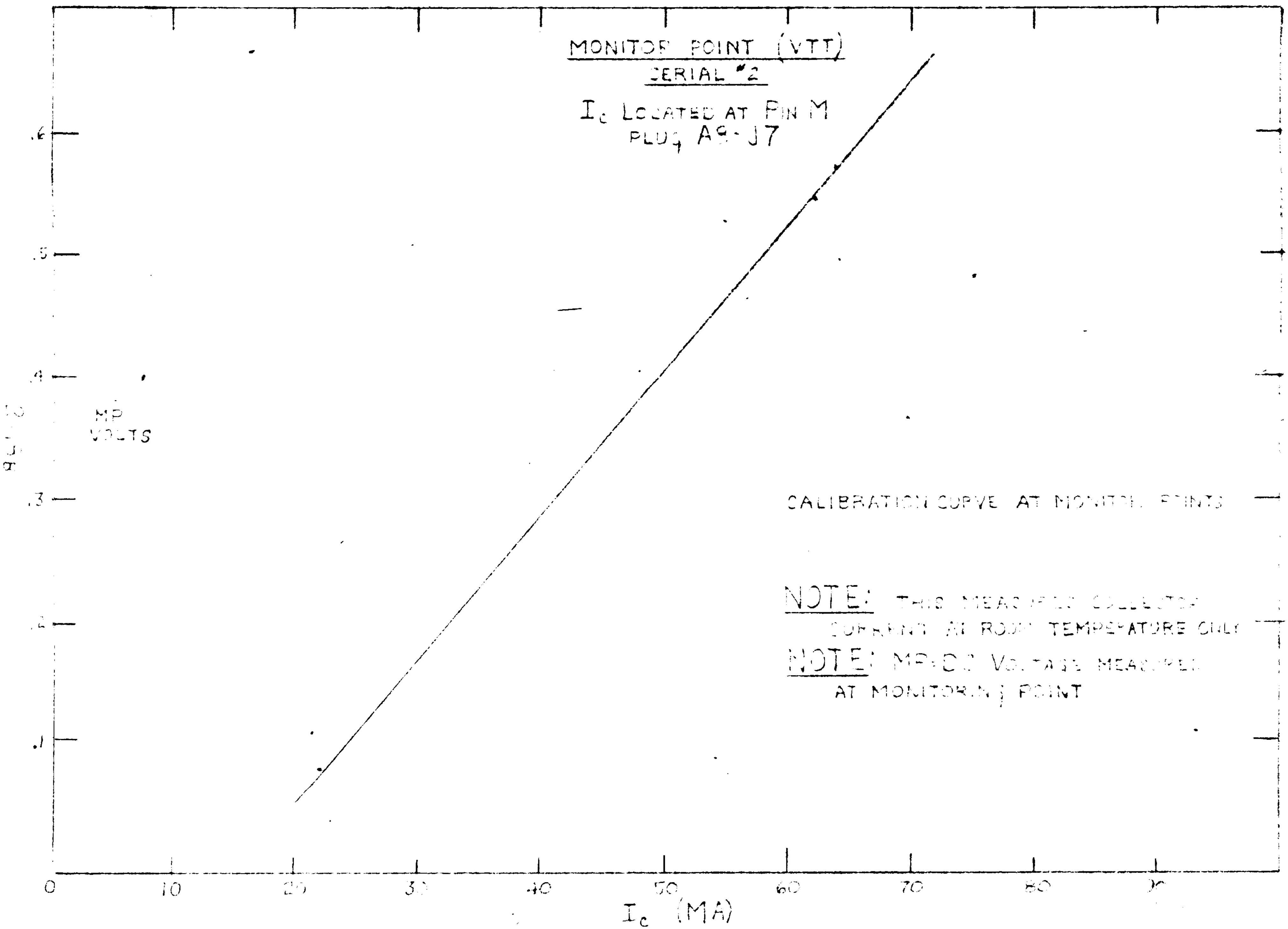


P_{out} (watts) LOCATED AT P_{in} C
OUTPUT POWER
MONITOR POINT
SERIAL #1
PLUG A8-J7
CALIBRATION CURVE AT
MONITOR POINTS
Note: MP = DC Voltage Measured
At Monitoring Point
Note: Calibrated At
Room Temperature
MP
(VOLTS)
0
1
2
3
4
5
0.5
1.0
1.5
2.0
2.5
3.0
Po (WATTS)

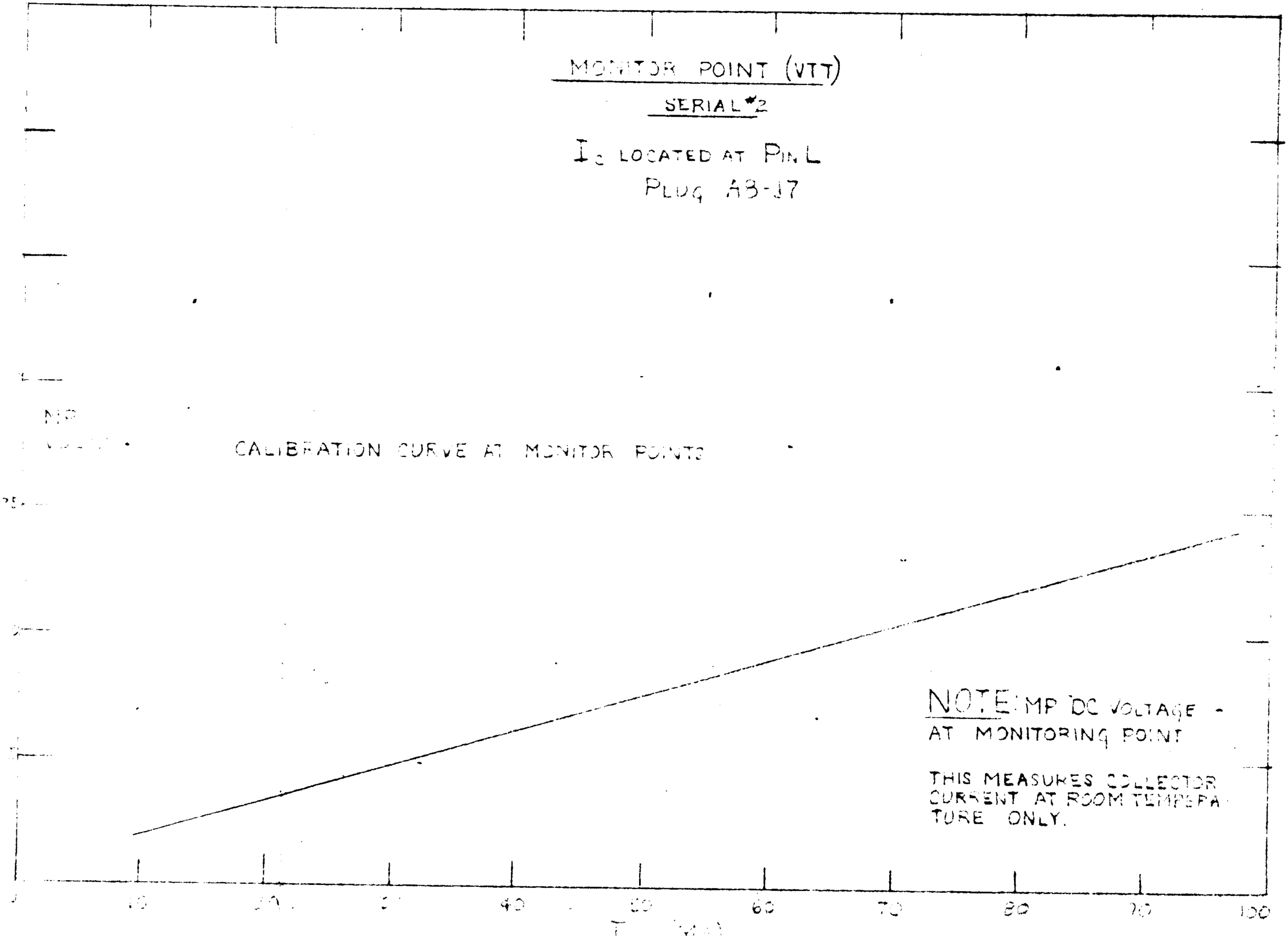
BUFFER AMPLIER



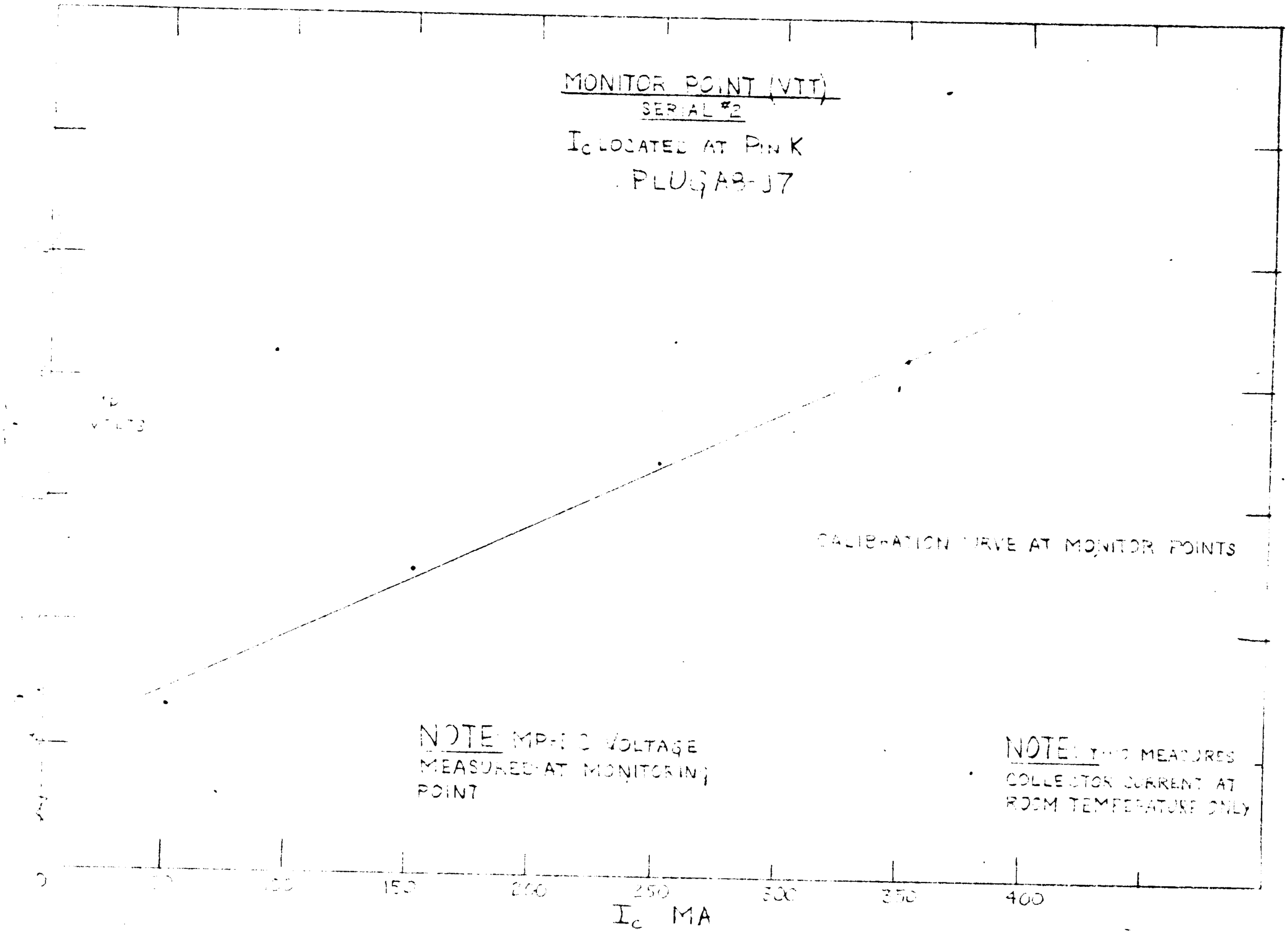
PHASE MODULATOR



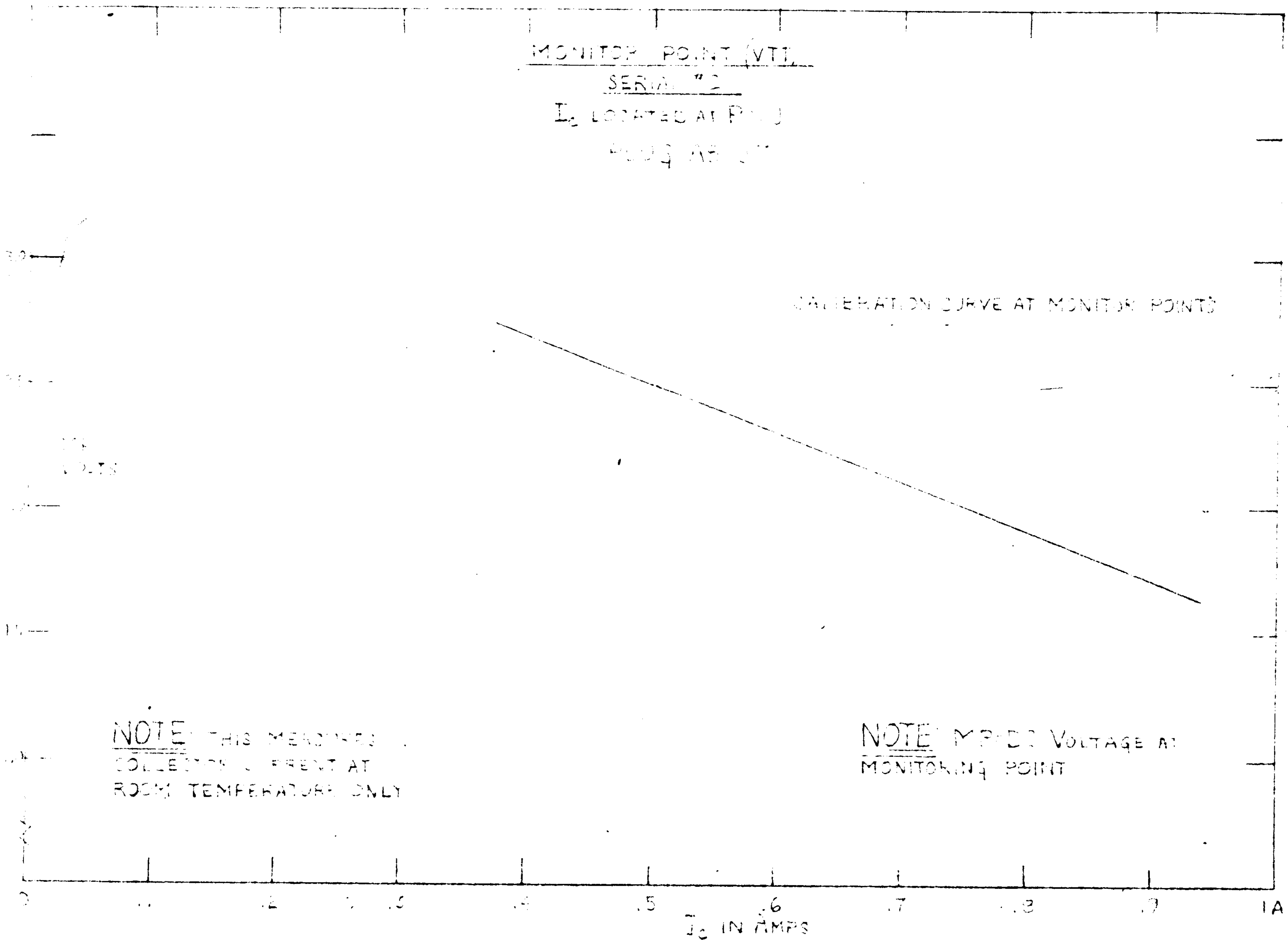
DRIVER AMPLIFIER



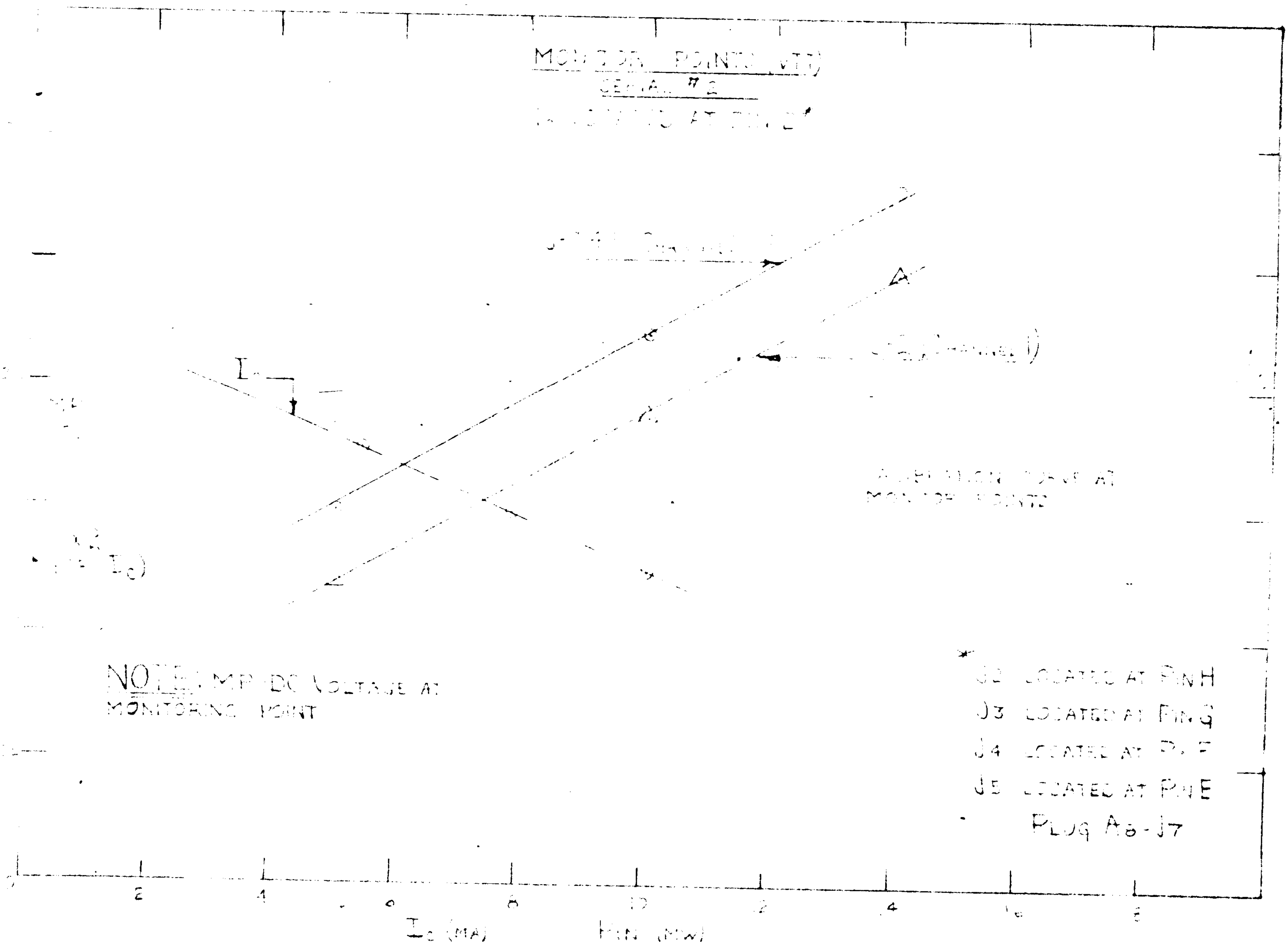
INTERMEDIATE POWER AMPLIFIER



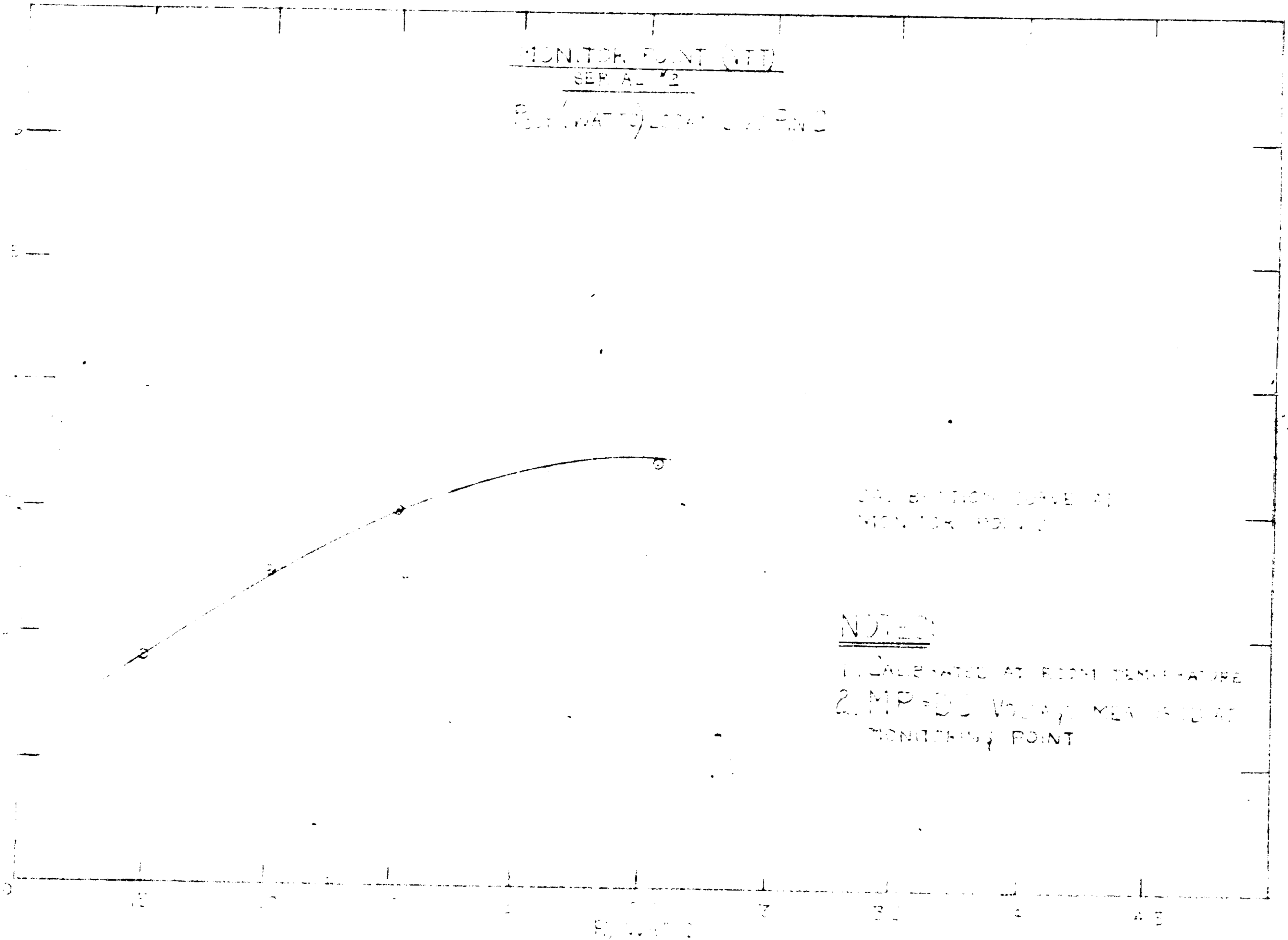
FINAL AMPLIFIER



ADDER AMPLIFIERS



OUTPUT POWER



2.7 Engineering Drawings

The engineering drawings prepared during the development phase of the Vehicle Tracking Transmitter were the following:

A10001 Block Diagram, Vehicle Tracking Transmitter

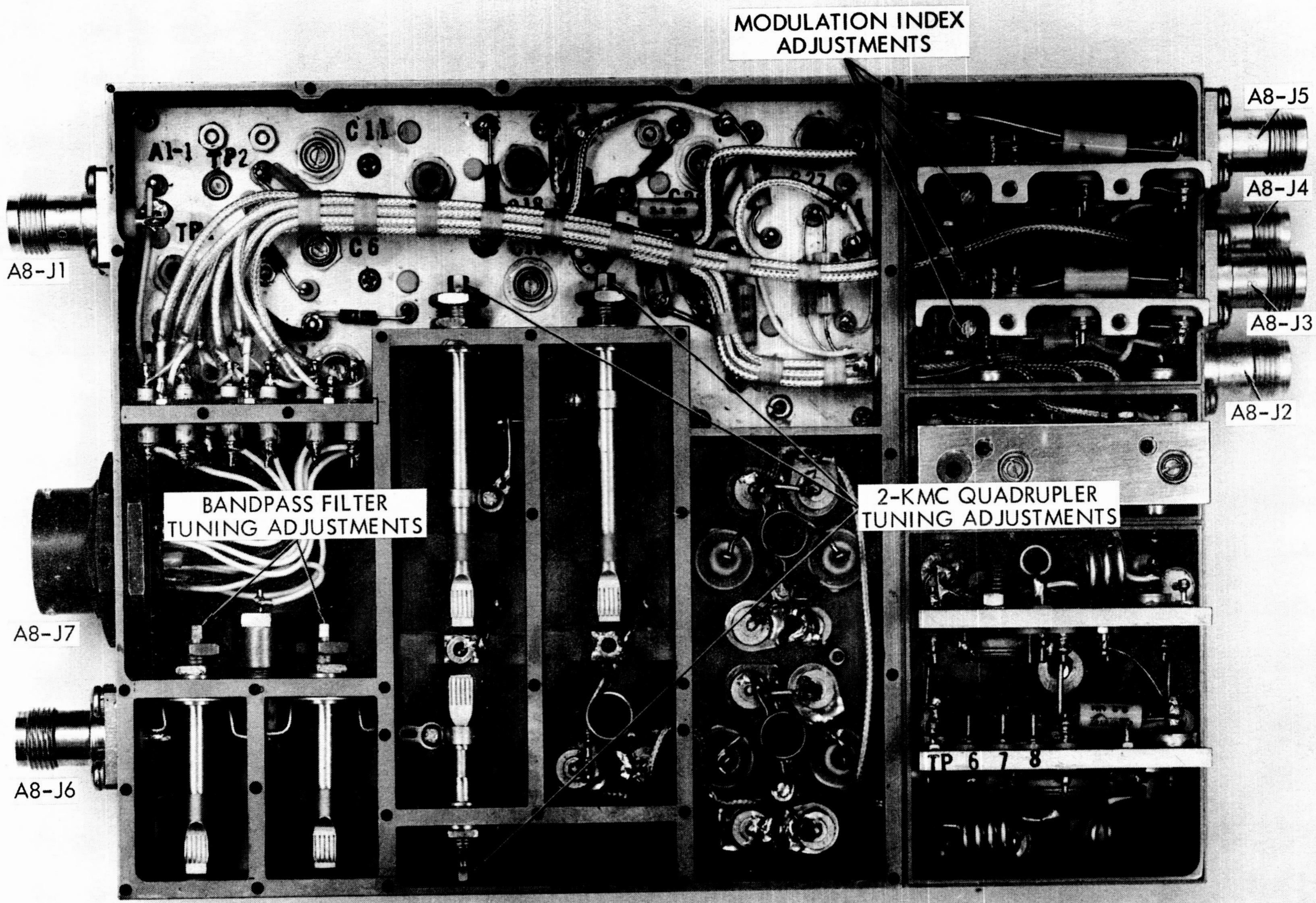
A10002 Schematic, Vehicle Tracking Transmitter

A10003 Main Layout, Vehicle Tracking Transmitter

A10004 Outline and Mounting Drawing, Vehicle Tracking Transmitter

2.8 Parts List for Vehicle Tracking Transmitter

The parts list for the Vehicle Tracking Transmitter is given on the following pages.



A10003 - MAIN LAYOUT VEHICLE TRACKING TRANSMITTER

ORIG: P. Spaur 10-3

APP:

MJO: 4126 CCC: 9331

SPACE TECHNOLOGY LABORATORIES, INC

PRELIMINARY PARTS LIST

PROJECT: AROD UNIT: TRANSMITTER DATE: 10-3

NO.:

SHEET 1 OF 4

SCHEMATIC: BUFFER-DOUBLER A1

ITEM	REFERENCE DESIGNATION	NO. REQD	MFR OR STL PART NUMBER	MANUFACTURER	DESCRIPTION
1	A1-C1	9	JMC 2950	Johanson	Variable Air Capacitor, .8-10 pf
	A1-C6				
	A1-C7				
	A1-C11				
	A1-C15				
	A1-C16				
	A1-C18				
	A1-C22				
	A1-C27				
2	A1-C2	2	CY10C150J	Corning	Fixed Glass Capacitor, 15 pf, 500V
	A1-C17				
3	A1-C3	1	CK05CW102K	Vitramon	Fixed Ceramic Capacitor, 1000 pf, 200V
4	A1-C4	3	CY10C100J	Corning	Fixed Glass Capacitor, 10 pf, 500V
	A1-C8				
	A1-C9				

ORIG: P. Spaur 10-3
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MJO: 4126 CCC: 9331

SPACE TECHNOLOGY LABORATORIES, INC

PRELIMINARY PARTS LIST

PROJECT: AROD UNIT: TRANSMITTER DATE: 10-3

NO.:

SCHEMATIC: BUFFER-DOUBLER A1

ITEM	REFERENCE DESIGNATION	NO. REQD	MFR OR STL PART NUMBER	MANUFACTURER	DESCRIPTION
5	A1-C5	6	SS5A-102W	Allen Bradley	Standoff Discoidal Capacitors, 500V
	A1-C10				
	A1-C12				
	A1-C21				
	A1-C23				
	A1-C24				
6	A1-C13	2	Cy10C5R0J	Corning	Fixed Glass Capacitors, 5pf, 500V
	A1-C19				
7	A1-C14	2	C80V	Aerovox	Cerafil Ceramic Capacitor, .01 uf, 100V, ± 20%
	A1-C30				
8	A1-C20	1	CY15C471J	Corning	Fixed Glass Capacitors, 470 pf, 500V
9	A1-C25	1	CY15C271J	Corning	Fixed Glass Capacitors 270 pf, 500V
10	A1-C26	1	CY10C270J	Corning	Fixed Glass Capacitors 27 pf, 500V
11	A1-C28	1	C80V	Aerovox	Cerafil Ceramic Capacitor, .05 MF, 100V ± 20%
12	A1-C29	1	CY10C430J	Corning	Fixed Glass Capacitor, 43 pf, 500V

ORIG: P. Spaur	10-3
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SPACE TECHNOLOGY LABORATORIES, INC

PRELIMINARY PARTS LIST

PROJECT: AROD UNIT: TRANSMITTER DATE: 10-3

NO.:	
SHEET 3	OF 4
SCHEMATIC: BUFFER-DOUBLER A1	

ITEM	REFERENCE DESIGNATION	NO. REQD	MFR OR STL PART NUMBER	MANUFACTURER	DESCRIPTION
13	A1-CR1	1	FD100	Fairchild	Diode, Silicon, High Speed
14	A1-CR2	1	1N643	PSI	Diode, Silicon
15	A1-CR3	1	1N967B	MIL-S-19500/117	Diode, Silicon Zener, 18 Volt ± 5%
16	A1-L1	1		STL	Coil .125 uh, 4T #24 Enamel, .187 dia Form
17	A1-L2	1	RFC-S-6.8	ACDC	RF Choke, Encapsulated
18	A1-L3	1		STL	Coil .269 uh, 8T #24 Enamel, .187 dia Form
19	A1-L4	5	RFC-S-2.2	ACDC	RF Choke, Encapsulated
	A1-L6				
	A1-L7				
	A1-L9				
	A1-L10				
20	A1-L5	1		STL	Coil .06 uh, 3T #16 Tinned 3/16 dia
21	A1-L8	1	RFC-S-47	ACDC	RF Choke, Encapsulated
22	A1-Q1	1	2N915	Fairchild	Transistor, Silicon
23	A1-Q2	1	2N1493	RCA	Transsistor, Silicon

ORIG: P. Spaur | 10-3
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MJO: 4126 | CCC: 9331

SPACE TECHNOLOGY LABORATORIES, INC

PRELIMINARY PARTS LIST

PROJECT: AROD UNIT: TRANSMITTER DATE: 10-3

NO.:
SHEET 4 OF 4
SCHEMATIC: BUFFER-DOUBLER A1

ITEM	REFERENCE DESIGNATION	NO. REQD	MFR OR STL PART NUMBER	MANUFACTURER	DESCRIPTION
24	A1-R1	1	RC07GF560J	MIL-R-11C	Resistor, 150 ohm $\frac{1}{4}$W, 5%
25	A1-R2	1	RC07GF101J	MIL-R-11C	Resistor, 68 ohm $\frac{1}{4}$W, 5%
26	A1-R3	1	RC07GF203J	MIL-R-11C	Resistor, 20K ohm $\frac{1}{4}$W, 5%
27	A1-R4	1	RC07GF8R2J	MIL-R-11C	Resistor, 8.2 ohm $\frac{1}{4}$W, 5%
28	A1-R5	2	RC07GF102J	MIL-R-11C	Resistor, 1K ohm $\frac{1}{4}$W, 5%
	A1-R10				
29	A1-R6	1	RC07GF204J	MIL-R-11C	Resistor, 200K ohm $\frac{1}{4}$W, 5%
30	A1-R7	1	RC07GF104J	MIL-R-11C	Resistor, 100K ohm $\frac{1}{4}$W, 5%
31	A1-R8	1	RC07GF302J	MIL-R-11C	Resistor, 3K ohm $\frac{1}{4}$W, 5%
32	A1-R9	1	RC07GF100J	MIL-R-11C	Resistor, 10 ohm $\frac{1}{4}$W, 5%
33	A1-R11	1	RC07GF392J	MIL-R-11C	Resistor, 3.9K ohm $\frac{1}{4}$W, 5%
34	A1-R12	1	RC07GF823J	MIL-R-11C	Resistor, 82K ohm $\frac{1}{4}$W, 5%
35	A1-T1	1		STL	Transformer
36	A1-T2	1		STL	Transformer
37	A1-VR1	2	PC107	PSI	Varactor
	A1-VR2				
38	A1-VR3	2	PC122	PSI	Varactor
	A1-VR4				

ORIG: P. Spaur	10-1
APP:	
MJO: 4126-02	CCC: 9331

SPACE TECHNOLOGY LABORATORIES, INC

PRELIMINARY PARTS LIST

PROJECT: AROD UNIT: TRANSMITTER DATE: 10-1-63

NO.:	
SHEET 1	OF 2
SCHEMATIC: DRIVER MODULE	A2

ITEM	REFERENCE DESIGNATION	NO. REQD	MFR OR STL PART NUMBER	MANUFACTURER	DESCRIPTION
1	A2-C1	3	JMC2950	Johanson	Variable Air Capacitor
	A2-C9				.8 - 10.0 uuf
	A2-C11				
2	A2-C2	1	CY10C390J	Corning	Fixed Glass Capacitor, 39 pf, 500V
3	A2-C3	1	CK05CW102K	Vitramon	Fixed Ceramic Capacitor, 001 mf, 200V
4	A2-C4	1	CY10C750J	Corning	Fixed Glass Capacitor, 75 pf, 500V
5	A2-C5	3	654-017-102K	Erie	Silver Mica Feedthru Capacitors
	A2-C7				1000 pf, 500V
	A2-C12				
6	A2-C6	1	CK06CW103K	Vitramon	Fixed Ceramic Capacitor, .01 mf, 200V
7	A2-C13	1	29F469	G.E.	Tantalum Capacitor, 1 mf, 150 V DC
8	A2-C8	1	150D226X0015B2	Sprague	Solid Tantalum Capacitor, 22 mf, 15V, ± 20%
9	A2-C10	1	CY10C050J	Corning	Fixed Glass Capacitor, 5 pf, 500V
10	A2-L1	3	RFC-S-2.2	ACDC	Encapsulated R.F. Choke
	A2-L2				
	A2-L3				
11	A2-L4	1		STL	Coil, Tank, 3T-#14GA Tinned Single Space

ORIG: P. Spaur	10-1
APP:	
MJO: 4126-01	CCC: 9331

SPACE TECHNOLOGY LABORATORIES, INC

PRELIMINARY PARTS LIST

PROJECT: AROD UNIT: TRANSMITTER DATE: 10-1-63

NO.: 35
SHEET 2 OF 2
SCHEMATIC: DRIVER MODULE A2

ITEM	REFERENCE DESIGNATION	NO. REQD	MFR OR STL PART NUMBER	MANUFACTURER	DESCRIPTION
12	A2-Q1	1	2N2631	RCA	Transistor
13	A2-R1	1	RW59V100	Sprague	Resistor, Wirewound, 10 ohm, 3W, 5%
14	A2-R2	1	RC07GF102J	MIL-R-11C	Resistor, 1K ohm, $\frac{1}{4}$W, 5%

ORIG: P. Spaur | 10-3
APP:
MJO: 4126 | CCC: 9331

SPACE TECHNOLOGY LABORATORIES, INC

PRELIMINARY PARTS LIST

PROJECT: AROD UNIT: TRANSMITTER DATE: 10-3

NO.:
SHEET 1 OF 4
SCHEMATIC: IPA AND FINAL A3

ITEM	REFERENCE DESIGNATION	NO. REQD	MFR OR STL PART NUMBER	MANUFACTURER	DESCRIPTION
1	A3-C1	3	MC603	JFD	Variable Air Capacitor 1-28 pf
	A3-C13				
	A3-C36				
2	A3-C2	1	to be selected	Corning	Fixed Glass Capacitor
3	A3-C3	4	CK05CW102K	Vitramon	Fixed Ceramic Capacitor, 1000 pf, 200V
	A3-C15				
	A3-C16				
	A3-C17				
4	A3-C4	5	SS5A-102W	Allen Bradley	Standoff Discoidal Capacitor, 1000 pf, 500V
	A3-C10				
	A3-C22				
	A3-C27				
	A3-C32				
5	A3-C5	1	C80V	Aerovox	Cerafil Ceramic Capacitor, .01 mf, 100V
6	A3-C6	4	CY10C300J	Corning	Fixed Glass Capacitor, 30 pf, 500V
	A3-C18				
	A3-C23				
	A3-C28				

ORIG: P. Speur 10-3
APP:
MJO: 4126 CCC: 9331

SPACE TECHNOLOGY LABORATORIES, INC

PRELIMINARY PARTS LIST

PROJECT: AROD UNIT: TRANSMITTER DATE: 10-3-63

NO.:
SHEET 2 OF 4
SCHEMATIC: IPA & FINAL A3

ITEM	REFERENCE DESIGNATION	NO. REQD	MFR OR STL PART NUMBER	MANUFACTURER	DESCRIPTION
7	A3-C7	9	654-017-102K	Erie	Silver Mica Feedthru Capacitor, 1000 pf, 500V
	A3-C8				
	A3-C19				
	A3-C20				
	A3-C24				
	A3-C25				
	A3-C29				
	A3-C30				
	A3-C37				
8	A3-C9	4	150D 105X0035A2	Sprague	Solid Tantalum Capacitor, 1 mf, 35V
	A3-C21				
	A3-C26				
	A3-C31				
9	A3-C11	1	C80V	Aerovox	Cerafil Ceramic Capacitor, .05 mf, 100V
10	A3-C12	2	150D 156X0050R2	Sprague	Solid Tantalum Capacitor, 15 mf, 50V
	A3-C38				
11	A3-C14	1	CY10C620J	Corning	Fixed Glass Capacitor, 47 pf, 500V

ORIG: P. Spaur | 10-3
APP:
MJO: 4126 | CCC: 9331

SPACE TECHNOLOGY LABORATORIES, INC

PRELIMINARY PARTS LIST

PROJECT: AROD   UNIT: TRANSMITTER   DATE: 10-3-63

NO.: RE
SHEET 3 OF 4
SCHEMATIC: IPA & FINAL   A3

ITEM	REFERENCE DESIGNATION	NO. REQD	MFR OR STL PART NUMBER	MANUFACTURER	DESCRIPTION
12	A3-C33	1	JMC2950	Johanson	Variable Air Capacitor .8-10 pf
13	A3-C34	1	CY10C150J	Corning	Fixed Glass Capacitor, 15 pf, 500V
14	A3-C35	1	CY10C100J	Corning	Fixed Glass Capacitor, 10 pf, 500V
15	A3-C39	1	CK06CW103K	Vitramon	Fixed Ceramic Capacitor, .01 mf, 200V
16	A3-CR1	1	1N1227	Westinghouse	Diode, Silicon
17	A3-CR2	1	1N971B	MIL-S-19500/117	Diode, Silicon, Zener, 27V ± 5%
18	A3-L1	5	RFC-S-2.2	ACDC	RF Choke, Encapsulated
	A3-L3				
	A3-L5				
	A3-L6				
	A3-L7				
19	A3-L2	1		STL	Coil 3T #14 Tinned, $\frac{1}{4}$" Dia.
20	A3-L4	1		STL	Coil 5T #18 Tinned, 5/32 Dia.
21	A3-L8	1		STL	Coil 1T #14 Tinned, $\frac{1}{4}$" Dia.
22	A3-L9	1	RFC-M-1.5	ACDC	RF Choke Encapsulated, 1.5 uh
23	A3-L10	1		STL	Coil 4T #14 Tinned $\frac{1}{4}$" Dia.

ORIG: P. Spaur	10-3
APP:	
MJO: 4126	CCC: 9331

SPACE TECHNOLOGY LABORATORIES, INC

PRELIMINARY PARTS LIST

PROJECT: AROD UNIT: TRANSMITTER DATE: 10-3-63

NO.:	RF
SHEET 4	OF 4
SCHEMATIC: IPA & FINAL	A3

ITEM	REFERENCE DESIGNATION	NO. REQD	MFR OR STL PART NUMBER	MANUFACTURER	DESCRIPTION
24	A3-Q1	4	DPT-2600	PSI	Transistor, Silicon
	A3-Q2				
	A3-Q3				
	A3-Q4				
25	A3-R1	5	RW59V2R0	Sprague	Resistor, Wirewound, 2 ohm, 3W, 5%
	A3-R3				
	A3-R4				
	A3-R5				
	A3-R6				
26	A3-R2	1	RC07GF102J	MIL-R-11C	Resistor, 1K ohm, $\frac{1}{4}$W, 5%
27	A3-R7	1	RC07GF511J	MIL-R-11C	Resistor, 510 ohm, $\frac{1}{4}$W, 5%

ORIG: Paul Spaur	10-3
APP:	
MJO: 4126	CCC: 9331

SPACE TECHNOLOGY LABORATORIES, INC

PRELIMINARY PARTS LIST

PROJECT: AROD UNIT: Transmitter DATE: 10-3-63

NO.:	REV:
SHEET 1 OF 5	
SCHEMATIC: ADDER AMPS.	

A4

ITEM	REFERENCE DESIGNATION	NO. REQD	MFR OR STL PART NUMBER	MANUFACTURER	DESCRIPTION
1	A4-C1	14	C80V	Aerovox	Cerafil Ceramic Capacitor .01 MF 100V
	A4-C2				
	A4-C5				
	A4-C6				
	A4-C7				
	A4-C10				
	A4-C11				
	A4-C12				
	A4-C13				
	A4-C16				
	A4-C17				
	A4-C18				
	A4-C21				
	A4-C22				
2	A4-C3	4	CY10C-J	Corning	Fixed Glass Capacitor 500V.
	A4-C8				Value to be Selected During Test.
	A4-C14				Approximate Value 150 PF.
	A4-C19				

ORIG: Paul Spaur | 10-21
APP:
MJO: 4126 | CCC: 9331

SPACE TECHNOLOGY LABORATORIES, INC

PRELIMINARY PARTS LIST

NO.: REV.
SHEET 2 OF 5
SCHEMATIC: ADDER AMPS. A4

PROJECT: AROD UNIT: Transmitter DATE: 10-21-63

ITEM	REFERENCE DESIGNATION	NO. REQD	MFR OR STL PART NUMBER	MANUFACTURER	DESCRIPTION
3	A4-C4	4	CY15C221J	Corning	Fixed Glass Capacitor 220 PF 500V.
	A4-C9				
	A4-C15				
	A4-C20				
4	A4-C23	1	150 D 156X0050R2	Sprague	Solid Tantalum Capacitors 15 MF 50V.
5	A4-CR1	4	FD100	Fairchild	Diode Silicon
	A4-CR2				
	A4-CR3				
	A4-CR4				
6	A4-CR5	1	1N971B	MIL-S-19500/117	Diode, Silicon Zener 27V. ± 5%
7	A4-L1	8	RFC-S-22	ACDC	RF Choke, Encapsulated 22 UH
	A4-L2				
	A4-L3				
	A4-L4				
	A4-L5				
	A4-L6				
	A4-L7				
	A4-L8				

ORIG: Paul Spaur	10-3
APP:	
MJO: 4126	CCC: 9331

SPACE TECHNOLOGY LABORATORIES, INC

PRELIMINARY PARTS LIST

PROJECT: AROD UNIT: Transmitter DATE: 10-3-63

NO.:	REV.
SHEET 3 OF 5	
SCHEMATIC: ADDER AMPS.	

A4

ITEM	REFERENCE DESIGNATION	NO. REQD	MFR OR STL PART NUMBER	MANUFACTURER	DESCRIPTION
8	A4-Q1	4	2N915	Fairchild	Transistor, Silicon
	A4-Q2				
	A4-Q3				
	A4-Q4				
9	Ae-R1	4	RC07GF510J	MIL-R-11C	Resistor 51 ohm 1/4W 5%
	A4-R10				
	A4-R19				
	A4-R28				
10	A4-R2	4	RC07GF511J		Resistor 510 ohm 1/4W 5%
	A4-R11				
	A4-R20				
	A4-R29				
11	A4-R3	4	RC07GF432J		Resistor 4.3K 1/4W 5%
	A4-R12				
	A4-R21				
	A4-R30			MIL-R-11C	

ORIG: Paul Spaur	10-3
APP:	
MJO: 4126	CCC: 9331

SPACE TECHNOLOGY LABORATORIES, INC

PRELIMINARY PARTS LIST

PROJECT: AROD UNIT: Transmitter DATE: 10-3-63

NO.:	REV.
SHEET 4 OF 5	
SCHEMATIC: ADDER AMPS.	

A4

ITEM	REFERENCE DESIGNATION	NO. REQD	MFR OR STL PART NUMBER	MANUFACTURER	DESCRIPTION
12	A4-R4	4	RC07GF334J	MIL-R-11C	Resistor 330K 1/4W 5%
	A4-R13				
	A4-R22				
	A4-R31				
13	A4-R5	4	RC07GF241J		Resistor 240 ohm 1/4W 5%
	A4-R14				
	A4-R23				
	A4-R32			MIL-R-11C	
14	A4-R6	4	236-L-1-502	Bourns	Potentiometer, Trimpot 5K ohm
	A4-R15				
	A4-R24				
	A4-R33				
15	A4-R7	4	RC07GF560J	MIL-R-11C	Resistor 56 ohm 1/4W 5%
	A4-R16				
	A4-R25				
	A4-R34				

ORIG: Paul Spaur	10-3
APP:	
MJO: 4126	CCC: 9331

SPACE TECHNOLOGY LABORATORIES, INC

PRELIMINARY PARTS LIST

NO.:	REV.
SHEET 5 OF 5	
SCHEMATIC: ADDER AMPS.	

A4

PROJECT: AROD UNIT: Transmitter DATE: 10-3-63

ITEM	REFERENCE DESIGNATION	NO. REQD	MFR OR STL PART NUMBER	MANUFACTURER	DESCRIPTION
16	A4-R8	4	RC07GF203J	MIL-R-11C	Resistor 20K ohm 1/4W 5%
	A4-R17				
	A4-R26				
	A4-R35				
17	A4-R9	4	RC07GF512J		Resistor 5.1K ohm 1/4W 5%
	A4-R18				
	A4-R27				
	A4-R36				
18	A4-R37	1	RC07GF201J		Resistor 200 ohm 1/4W 5%
19	A4-R38	1	RC07GF202J		Resistor 2K ohm 1/4W 5%

ORIG: P. Spaur	10-21
APP:	
MJO: 4126	CCC: 9331

SPACE TECHNOLOGY LABORATORIES, INC

PRELIMINARY PARTS LIST

PROJECT: AROD UNIT: TRANSMITTER DATE: 10-21-63

NO.: RE	
SHEET 1	OF 1
SCHEMATIC: 1st MULTIPLIER A5	

ITEM	REFERENCE DESIGNATION	NO. REQD	MFR OR STL PART NUMBER	MANUFACTURER	DESCRIPTION
1	A5-C1	8	JMC2950	Johanson	Variable Air Capacitor, .8 - 10 pf
	A5-C3				
	A5-C4				
	A5-C6				
	A5-C8				
	A5-C9				
	A5-C10				
	A5-C11				
2	A5-C2	2	CY10C100J	Corning	Fixed Glass Capacitor, 10 pf, 500V
	A5-C5				
3	A5-C7	1	CY10C5R0J	Corning	Fixed Glass Capacitor, 5 pf, 500V
4	A5-R1	1	RC07GF124J	MIL-R-11C	Resistor, 120K ohm $\frac{1}{4}$W, 5%
5	A5-R2	1	RC07GF514J	MIL-R-11C	Resistor, 510K ohm, $\frac{1}{4}$W, 5%
6	A5-T1	1		STL	Transformer Pri 3T #16 Enam Sec 5T #16 Enam C.T. $\frac{1}{4}$" Form
7	At-T2	1		STL	Transformer Pri 2T #16 Sec 3T #16 C.T. $\frac{1}{4}$" Form
8	A5-VR1	4	MA4061A	Microwave Assoc	Varactor
	A5-VR2				
	A5-VR3 A5-VR4				

ORIG: P. Spaur 10-22
APP:
MJO: 4126-02 CCC: 9331

SPACE TECHNOLOGY LABORATORIES, INC

PRELIMINARY PARTS LIST

PROJECT: AROD UNIT: TRANSMITTER DATE: 10-22

NO.:
SHEET 1 OF 1
SCHEMATIC: 2nd MULTIPLIER A6

ITEM	REFERENCE DESIGNATION	NO. REQD	MFR OR STL PART NUMBER	MANUFACTURER	DESCRIPTION
1	A6-C1	2		Johanson	
	A6-C2				
2	A6-L1	1		STL	Coil 2T #16, $\frac{1}{4}$" Dia.
3	A6-R1	2	RC07GF204J	MIL-R-11C	Resistor, 200K ohm, $\frac{1}{4}$W, 5%
	A6-R2				
4	A6-VR1		MA4347C1	Microwave Assoc	Varactor
	A6-VR2				

ORIG: P. Spaur 10-22

APP:

MJO: 4126-02 CCC: 9331

SPACE TECHNOLOGY LABORATORIES, INC

PRELIMINARY PARTS LIST

NO.: RF

SHEET 1 OF 1

SCHEMATIC: BAND PASS FILTER A7

PROJECT: AROD UNIT: TRANSMITTER DATE: 10-22

ITEM	REFERENCE DESIGNATION	NO. REQD	MFR OR STL PART NUMBER	MANUFACTURER	DESCRIPTION
1	A7-CR1	1	1N21CR		Diode
2	A7-R1	1	RC07GF203J	MIL-R-11C	Resistor, 20K, $\frac{1}{4}$W, 5%

ORIG: P. Spaur	10-4
APP:	
MJO: 4126	CCC: 9331

SPACE TECHNOLOGY LABORATORIES, INC

PRELIMINARY PARTS LIST

PROJECT: AROD UNIT: TRANSMITTER DATE: 10-4-63

NO.:	
SHEET 1	OF 2
SCHEMATIC: BASEPLATE	A8

ITEM	REFERENCE DESIGNATION	NO. REQD	MFR OR STL PART NUMBER	MANUFACTURER	DESCRIPTION
1	A8-FL1	12	1203-050	Erie	Filter, Feedthru. Eyelet Type
	A8-FL2				
	A8-FL3				
	A8-FL4				
	A8-FL5				
	A8-FL6				
	A8-FL7				
	A8-FL8				
	A8-FL9				
	A8-FL10				
	A8-FL11				
	A8-FL12				
2	A8-FL13	6	FA5C-102W	Allen Bradley	Feedthru Discoidal Capacitor
	A8-FL14				
	A8-FL15				
	A8-FL16				
	A8-FL17				
	A8-FL18				

ORIG: P. Spaur	10-4
APP:	
MJO: 4126	CCC: 9331

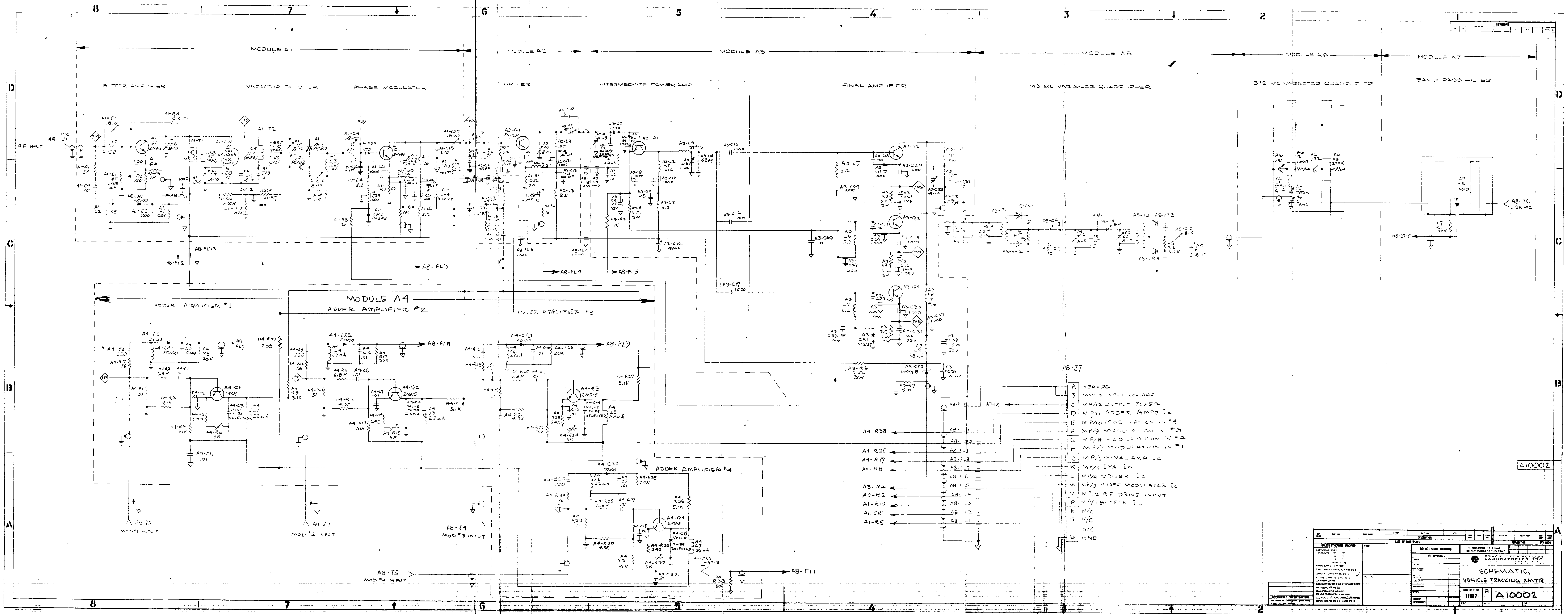
SPACE TECHNOLOGY LABORATORIES, INC

PRELIMINARY PARTS LIST

PROJECT: AROD UNIT: TRANSMITTER DATE: 10-4-63

NO.:
SHEET 2 OF 2
SCHEMATIC: BASE PLATE A8

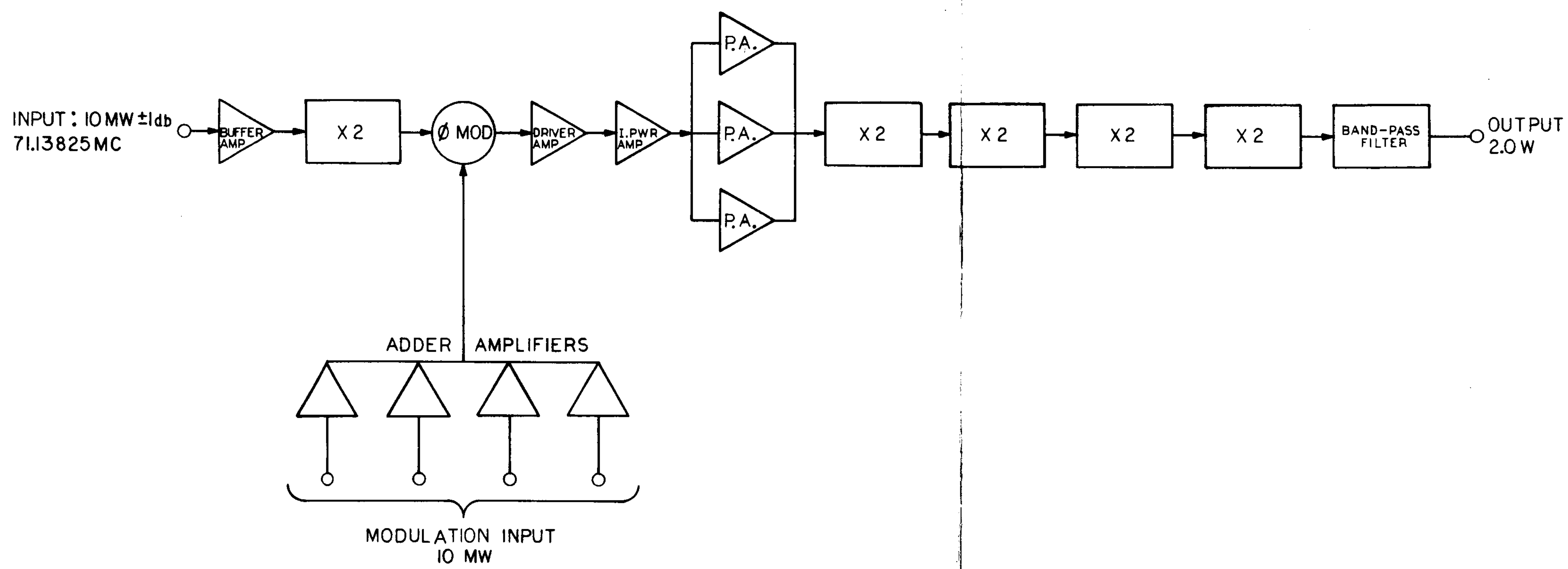
ITEM	REFERENCE DESIGNATION	NO. REQD	MFR OR STL PART NUMBER	MANUFACTURER	DESCRIPTION
3	A8-J1	6	82088A	General Refittings	Connector, Coaxial, Type TNC
	A8-J2				
	A8-J3				
	A8-J4				
	A8-J5				
	A8-J6				
4	A8-J7	1	PT07P14-18P	Bendix Scintilla	Connector, Power


MODULE A1
MODULE A2
MODULE A3
MODULE A5
MODULE A6
MODULE A7
BUFFER AMPLIFIER
VARACTOR DOUBLER
PHASE MODULATOR
DRIVER
INTERMEDIATE POWER AMP
FINAL AMPLIFIER
43 MC VARACTOR QUADRUPLER
572 MC VARACTOR QUADRUPLER
BAND PASS FILTER
RF INPUT
A8-J1
A8-J6
2.2K MC
MODULE A4
ADDER AMPLIFIER #1
ADDER AMPLIFIER #2
ADDER AMPLIFIER #3
ADDER AMPLIFIER #4
A8-J2
MOD #1 INPUT
A8-J3
MOD #2 INPUT
A8-J4
MOD #3 INPUT
A8-J5
MOD #4 INPUT
A8-FL11
A8-J7
A +30 VDC
B M/13 INPUT VOLTAGE
C M/12 OUTPUT POWER
D M/11 ADDER AMPS Ic
E M/10 MODULATION IN #4
F M/9 MODULATION IN #3
G M/8 MODULATION IN #2
H M/7 MODULATION IN #1
J M/6 FINAL AMP Ic
K M/5 IPA Ic
L M/4 DRIVER Ic
M M/3 PHASE MODULATOR Ic
N M/2 RF DRIVE INPUT
P M/1 BUFFER Ic
R N/C
S N/C
T N/C
U GND
A10002
LIST OF MATERIALS
UNLESS OTHERWISE SPECIFIED
DO NOT SCALE DRAWING
STL APPROVALS
THE FOLLOWING E.O.'S HAVE BEEN ATTACHED TO THIS PRINT
SPACE TECHNOLOGY LABORATORIES, INC.
SCHEMATIC,
VEHICLE TRACKING XMTR
CODE IDENT NO
11982
A10002
APPLICATION
APPLICABLE SPECIFICATIONS

THE INFORMATION AND TECHNICAL DATA DISCLOSED BY THIS DOCUMENT MAY BE USED AND DISSEMINATED FOR THE PURPOSES AND TO THE EXTENT AUTHORIZED BY SPACE TECHNOLOGY LABORATORIES, INC. IN ANY PROPOSAL, CONTRACT OR OTHER WRITTEN INSTRUMENT. SUCH INFORMATION AND TECHNICAL DATA ARE PROPRIETARY TO SPACE TECHNOLOGY LABORATORIES, INC. AND MAY NOT BE USED OR DISSEMINATED EXCEPT AS PROVIDED IN THE FOREGOING SENTENCE.

ZONE	SYM	DESCRIPTION	BY	DATE	CK'D	APPROVAL

REVISIONS



A10001

1. IDENTIFICATION MARKING IN ACCORDANCE WITH STL SPEC. PR 12-1
TYPE____CLASS____PART NUMBER____

NOTES: UNLESS OTHERWISE SPECIFIED

REQD PER NOTED ASSY — CONFIGURATION

PART NO.	PART NAME	STOCK	MATERIAL	SPEC	CKT REF	CODE IDENT	ZONE	ITEM NO.

DESCRIPTION — LIST OF MATERIALS

USED ON	NEXT ASSY	NEXT ASSY	FINAL ASSY

APPLICATION — QTY REQD

UNLESS OTHERWISE SPECIFIED
1 DIMENSIONING & TOLERANCING PER MIL-STD-8.
2 DIMENSIONS IN INCHES TOLERANCES .XXX=±.010 .XX=±.03 .X=±.1 ANGLES±0°30'
3 STD HOLE TOLERANCES PER AND10387.
4 ALL DIMS TO APPLY AFTER PLATING OR CONVERSION COATING.
5 REMOVE BURRS & SHARP EDGES.
6 SURFACE ROUGHNESS PER MIL-STD-10. ✓
7 RIVET CODING PER NAS 523.
8 WELD SYMBOLS PER JAN-STD-19.
9 THREADS PER MIL-STD-9, MIL-S-7742 & MIL-P-7105.
10 ELECTRICAL & ELECTRONIC SYMBOLS & REFERENCE DESIGNATIONS PER MIL-STD-15 & MIL-STD-16.

APPLICABLE SPECIFICATIONS
THE ABOVE REFERENCED STL SPECS FORM A PART OF THIS DRAWING

FINISH

HEAT TREAT

DO NOT SCALE DRAWING

STL APPROVALS		
DRAWN	[signature]	9-18-63
CHECKED		
STRUCTURES		
MAT'LS & PROCESSES		
ENGR		
SUPERVISION		
SPECIAL		
OTHER APPROVALS		

THE FOLLOWING E.O.'S HAVE BEEN ATTACHED TO THIS PRINT

SPACE TECHNOLOGY LABORATORIES, INC.
A SUBSIDIARY OF THOMPSON RAMO WOOLDRIDGE INC.
ONE SPACE PARK • REDONDO BEACH, CALIFORNIA

BLOCK DIAGRAM,
VEHICLE
TRACKING TRANSMITTER

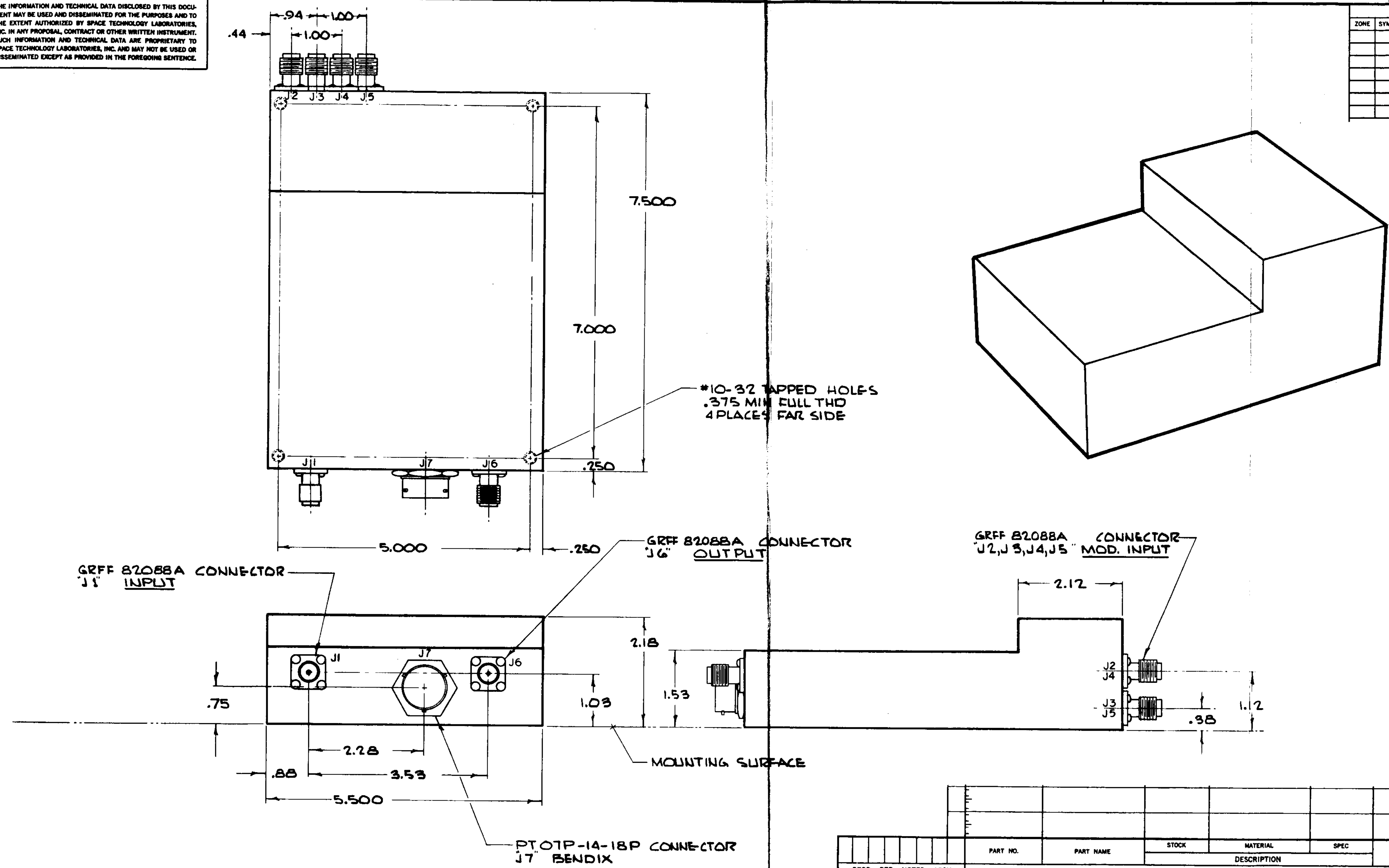
CODE IDENT NO. 11982 | DWG SIZE D | A10001

SCALE | WEIGHT | SHEET

DIETERICH-POST CLEARPRINT 1000

STL FORM 1451D REV. 10-62

THE INFORMATION AND TECHNICAL DATA DISCLOSED BY THIS DOCUMENT MAY BE USED AND DISSEMINATED FOR THE PURPOSES AND TO THE EXTENT AUTHORIZED BY SPACE TECHNOLOGY LABORATORIES, INC. IN ANY PROPOSAL, CONTRACT OR OTHER WRITTEN INSTRUMENT. SUCH INFORMATION AND TECHNICAL DATA ARE PROPRIETARY TO SPACE TECHNOLOGY LABORATORIES, INC. AND MAY NOT BE USED OR DISSEMINATED EXCEPT AS PROVIDED IN THE FOREGOING SENTENCE.



A 10004

REVISIONS						
ZONE	SYM	DESCRIPTION	BY	DATE	CK'D	APPROVAL

1. IDENTIFICATION MARKING IN ACCORDANCE WITH STL SPEC. PR 12-1
TYPE____CLASS____PART NUMBER____

NOTES: UNLESS OTHERWISE SPECIFIED

REQD PER NOTED ASSY	PART NO.	PART NAME	STOCK	MATERIAL	SPEC	CKT REF	CODE IDENT	ZONE	ITEM NO.
CONFIGURATION	LIST OF MATERIALS		DESCRIPTION						

USED ON	NEXT ASSY	NEXT ASSY	FINAL ASSY
APPLICATION		QTY REQD	

UNLESS OTHERWISE SPECIFIED
1 DIMENSIONING & TOLERANCING PER MIL-STD-8.
2 DIMENSIONS IN INCHES
TOLERANCES .XXX=±.010 .XX=±.03 .X=±.1
ANGLES±0°30'
3 STD HOLE TOLERANCES PER AND10387.
4 ALL DIMS TO APPLY AFTER PLATING OR CONVERSION COATING.
5 REMOVE BURRS & SHARP EDGES.
6 SURFACE ROUGHNESS PER MIL-STD-10. ✓
7 RIVET CODING PER NAS 523.
8 WELD SYMBOLS PER JAN-STD-19.
9 THREADS PER MIL-STD-9, MIL-S-7742 & MIL-P-7105.
10 ELECTRICAL & ELECTRONIC SYMBOLS & REFERENCE DESIGNATIONS PER MIL-STD-15 & MIL-STD-16.

FINISH

HEAT TREAT

APPLICABLE SPECIFICATIONS
THE ABOVE REFERENCED STL SPECS FORM A PART OF THIS DRAWING

DO NOT SCALE DRAWING

STL APPROVALS	
DRAWN	8-31-63
CHECKED	
STRUCTURES	
MAT'LS & PROCESSES	
ENGR	
SUPERVISION	
SPECIAL	
OTHER APPROVALS	

THE FOLLOWING E.O.'S HAVE BEEN ATTACHED TO THIS PRINT

SPACE TECHNOLOGY LABORATORIES, INC.
A SUBSIDIARY OF THOMPSON RAMO WOOLDRIDGE INC.
ONE SPACE PARK • REDONDO BEACH, CALIFORNIA

OUTLINE AND MOUNTING DRAWING, VEHICLE TRACKING TRANSMITTER

CODE IDENT NO.	DWG SIZE	
11982	D	A 10004
SCALE 1/1	WEIGHT	SHEET 1 OF 1

DIETERICH-POST CLEARPRINT 1000

STL FORM 1461D REV. 10-62